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Construction Methods and Equipment

Graw-Hill Publishing Company, Inc.

December, 1936

Price 20 Cents

HYDRAULIC JACKS, 150 ft. above Harlem River, New York City, open crown of 800-ft. main arch span of Henry Hudson bridge to permit insertion of closure piece creating world's longest hingeless arch.

UNIVERSAL

HEADQUARTERS *for* TRUCK CRANES *and* TRUCK SHOVELS

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★ In 1918, Universal built the pioneer truck mounted crane—today, the total number of Universals in service is several times the total of all other truck cranes combined.

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Today, Universal maintains its leadership in offering you greater values and advantages than ever before. The new Universal-Lorains for motor truck mounting are built to the Thew Center Drive principle of Simplicity, Ruggedness, Speed and Power . . . Universal-Lorains are built in 3 models—as cranes, up to 8½ tons capacity; as shovels, up to ¾ cu. yd.

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6½-8½ ton CRANES
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that—

load and unload cars
charge bins
dig ditches
build berms
strip gravel
handle grading
drive piles
dig bridge abutments
remove slides
lay pipe
build bridges
erect steel
build culverts

TECHNOLOGY DEPT.

CURRENT JOBS

...and Who's Doing Them

Buildings

Public—The Housing Division of PWA let a $1,388,600 contract for superstructure of Langston Terrace Housing Project in Washington, D.C., to **Coath & Goss,** of Chicago. Another PWA Housing Division contract at Omaha, Neb., covering superstructure for Logan Fontenelle Homes, went to **Peter Kiewit's Sons Co.,** of Omaha, Neb., $1,283,000. For a state tuberculosis ward building at Dixon, Ill., the bid of $794,750 submitted by **A. Smith & Co.,** of Chicago, was low for the general contract. A gymnasium at the U.S. Military Academy, at West Point, N.Y., will be built by **C. T. Wills, Inc.,** of New York City, for $735,000. A garage for the New York City Department of Sanitation was bid in by **William Kennedy Constr. Co.,** of Brooklyn, for $657,873. In San Diego, Calif., **B. O. Larsen,** of San Diego, bid $627,069 for completion of city and county administration building. The successful bidder for a college library building at Albuquerque, New Mex., was **Platt Rogers, Inc.,** of Pueblo, Colo., with price of $312,800.

Industrial—Plant extensions and improvements by the San Diego Consolidated Gas & Electric Co., in Calif., costing $2,220,000 will be done by force account under supervision of **Byllesby Engineering & Management Corp.** A 7-story beer fermenting building for Anheuser Busch, Inc., at St. Louis, Mo., will be built for $750,000 by **Fruin-Colnon Contg. Co.,** of St. Louis.

River and Harbor Work

The bid of $3,441,283 for lock and dam on Warrior River at Tuscaloosa, Ala., by **Hardaway Contracting Co.,** of Columbus, Ga., was low. The **Central Engineering Co.,** of Davenport, Ia., bid in for $1,979,862, Dam 14 at LeClaire, Ia. The Fresno dam on the Milk River reclamation project in Montana, will be built for $980,804 by **Wachter-O'Neill Construction Co. & McGarry Bros.,** Bismarck, N.D. A bid of $729,435 obtained for a **G. W. Condon Co.,** Omaha, Neb., contract for the Boca dam at Boca, Calif. For repairing a jetty at the mouth of the Umpqua River, **Kern & Kibbe,** of Portland, Ore., were low bidders with $939,405. Dredging contracts in Chesapeake and Delaware Canal in Delaware and Maryland were obtained by the **Arundel Corp.,** of Baltimore, for $619,691 and by the **Atlantic Gulf & Pacific Co.,** of New York City, for $626,691. Another contract for dredging the James River in Virginia was obtained by **W. H. Gahagan Construction Co.,** of Brooklyn, N.Y., for $519,125.

Highways

In Colorado, **Gordon Construction Co.,** of Denver, obtained a $389,263 contract for gravel surfacing in Mt. Vernon Canyon. In the same state, between Cortez and Lewis, **Cook & Ransom,** of Ottawa, Kan., bid $270,438, for gravel surfacing. Indiana highway contracts included two, aggregating $669,134, to the **Calumet Paving Co.,** of Indianapolis. In Iowa the **Western Paving Corp.,** of Sioux City, obtained a $324,837 contract for paving near Dakota city. Minnesota let a $353,356 contract at West Duluth to **Thornton Bros.,** of St. Paul, Minn. In Missouri, the **Independent Construction Co.,** of Pittsburg, Kan., obtained paving contracts amounting to $358,323. A Blue Ridge Parkway contract in North Carolina, went to **M. E. Gillioz,** of Monett, Mo., for $656,000. The **Dudley Stone Products Co.,** of El Paso, Tex., obtained $228,193 contract in New Mexico for culverts, bridges and stone surfacing. Another New Mexico contract amounting to $279,394 for gravel surfacing was obtained by **L. R. Allison,** of Albuquerque. In McKeesport, Pa., **Shullo Constr. Co.,** of Akron, Ohio, bid $738,841 for raising street and buildings, grading and paving. In Pennsylvania, **M. Manella,** of Pittsburgh, got a $450,688 contract for concrete paving and bridges in Rochester, Pa.

Construction Methods

AND EQUIPMENT

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ROBERT K. TOMLIN, Editor — DECEMBER, 1936 — WILLARD CHEVALIER, Vice-President

Editorial Staff: Vincent B. Smith, John B. Huttl (San Francisco) Nelle Fitzgerald

The "How" of it:

(For the benefit of readers concerned with the practical application of method or equipment the following references are to articles or illustrations in this issue that tell:)

How MELTING ICE CAKES were utilized to lower 40-ton tanks on to new foundations. — p. 25

How CANTILEVER ERECTION of long-span fixed steel arch was aided by hydraulic jacks under falsework bents and by toggles erected on ribs. — p. 29

How HYDRAULIC JACKS at crown of fixed steel arch widened opening between cantilevered halves of arch to receive closure piece. — p. 30

How TRUCK BODIES of 25-cu.yd. capacity handled rockfill for big dam. — p. 33

How THIN CONCRETE SLABS for walls of small houses were precast in shop and trucked to site for erection. — p. 34

How MOSAIC CONCRETE of exposed aggregate type was cast in horizontal molds. — p. 35

How QUICK VISUAL TEST of moisture content in rolled earthfill embankment was made possible by observing behavior under equipment. — p. 36

How DAM BUILDERS organized operations in starting construction of earthfill embankment. — p. 40

How EXPANSION JOINT with interlocking steel "fingers" protects concrete roadway on bridge. — p. 44

How RAISING OF SETTLED PAVEMENT to proper sidewalk grade was done with mud-jack. — p. 44

How TRACTOR CRANE raised 72-ft. wood poles for flood-lighting athletic field. — p. 45

How FOUNDATION CONCRETE for mill building was delivered from paver by belt conveyor with 50-ft. reach. — p. 45

How ROAD SHOULDERS were rolled with home-made rig. — p. 45

How ELONGATED TRAILER was rigged to handle 40-ft. lengths of steel pipe. — p. 45

How LIGHTWEIGHT ALUMINUM BOOMS on draglines make possible 15 per cent increase in length or 20 per cent increase in bucket capacity. — p. 46

How SAFETY NET of manila rope is hung under big bridge to catch falling workers. — p. 50

How CURING of concrete pavement was done with wet cotton mats. — p. 51

How TRAVELING CARRIAGE, riding on road forms, handled cotton mats for curing concrete. — p. 51

How SOLID-ROW HOUSING permits sound construction at low cost. — p. 52

CURRENT JOBS

...and Who's Doing Them

Waterworks

A $692,916 contract at San Francisco, Calif., went to **MacDonald & Kahn,** of San Francisco, for completing University Mound reservoir. For a 48-in. steel pipe line in Everett, Mass., **V. J. Grande Co.,** of Brighton, Mass., bid $217,689. A well for the water supply system of Webster, N.Y., is being driven by **Layne New York Co.,** of New York City, for $200,000.

In Birmingham, Ala., the **Chicago Bridge & Iron Works** and the **Ingalls Iron Works Co.,** were awarded by the city a $1,236,000 contract for 42- to 60-in. steel pipe for water works. Excavating and embankment for Sunset reservoir, in San Francisco, went to **Piombo Bros.,** of San Francisco, for $238,121.

Bridges

Bridge contract awards by State Highway Departments included the following. In Minnesota, **Okes Construction Co.,** of St. Paul, $333,041. In Colorado, **M. E. Carlson,** of Denver, $307,932. In Florida, **C. Y. Thomason Construction Co.,** of Greenwood, S.C., $365,490. In Ohio, **Mansfield Asphalt Paving Co.,** of Mansfield, $242,912. Also, in Ohio, **W. E. McHugh,** of Cleveland, $215,448.

Sewers

At a price of $1,547,175 to **Cauldwell-Wingate Co.,** of New York, will build for the New York City Department of Sanitation, superstructure for Wards Island Sewage Treatment works. At Cleveland, Ohio, a $1,012,000 contract for sewage plant aeration building was obtained by **Lundoff-Bicknell Co.,** of Cleveland, Ohio. **V. B. Higgins & Co.,** of Charlotte, N.C., obtained a $619,374 contract for sewage disposal plant at Greensboro, N.C. A sewage plant equipment contract in Cleveland, Ohio, was bid in for $397,300 by **Nichols Engineering & Research Corp.,** of New York. For building the South River sewage disposal plant in Atlanta, Ga., the **Virginia Engineering Co.,** of Newport News, Va., was successful bidder with a price of $233,400.

The Chicago Sanitary District awarded to **Paschen Bros.,** of Chicago, contract amounting to $369,195, for portion of the North Side treatment works; from the same source, **S. A. Healy Co.,** of Chicago, obtained a $1,259,710 award for the Upper Des Plaines intercepting sewer. For a sewage disposal plant in Milford, Conn., **O'Neil Bros., Inc.,** of Hartford, were low bidders with $136,175. In New Orleans, **J. Riess,** contractor, obtained contracts for sewage pumping station and sewers, totaling $447,575. For a sanitary sewer outfall in Greensboro, N. C., the successful bidder was **A. G. Pinkston & Co.,** of Norfolk, Va., at $235,400.

Miscellaneous

Another section of the Sixth Ave. subway in New York City, was bid in for $7,934,607 by the **Park Contracting Corp.,** of New York. For completing the Broadway tunnel in Oakland, Calif., **R. G. Clifford,** of San Francisco, was awarded a $731,000 contract. In Quebec, Canada, a wharf is being built for $700,000 by **A. Janin & Co., Ltd.,** of Montreal.

Next Month... ANNUAL ROAD BUILDERS' NUMBER

A New Need— A New Name

TODAY construction faces a clearly defined trend toward higher costs. Already we are feeling a shortage of qualified and competent labor; wage rates are making for new highs; the recovery cycle is entering the stage that foreshadows vast expansion of construction activity.

The constructor who will be able to cope with these conditions—to bid in the jobs and to handle them profitably—is the one who keeps his field staff most closely abreast of what is available in improved methods, equipment and materials. The only effective answer to rising costs is more skillful and resourceful field management. This implies the fullest possible knowledge of the best practice in handling the men, materials and machinery of construction.

To help constructors in this task is the mission of this journal; our adherence to that course has been amply justified by the testimony of many field men concerning its practical value to them.

Now, to help them meet the prevailing trend toward higher costs, we offer, beginning with the January issue, a substantially expanded treatment of the Equipment News department, with special emphasis on the more effective use of modern equipment and materials, as these are made available by their manufacturers.

It is our hope that the readers of *Construction Methods* will find this development in step with their increasing need for a comprehensive periodical review of what is newest and best in field practice. And in recognition of the rising importance of equipment as a vital factor in that practice, we announce a revision of the name of this journal, which now becomes

Construction Methods and Equipment

Willard Chevalier

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OFFERING MORE ECONOMY FOR MANY HAULING NEEDS-

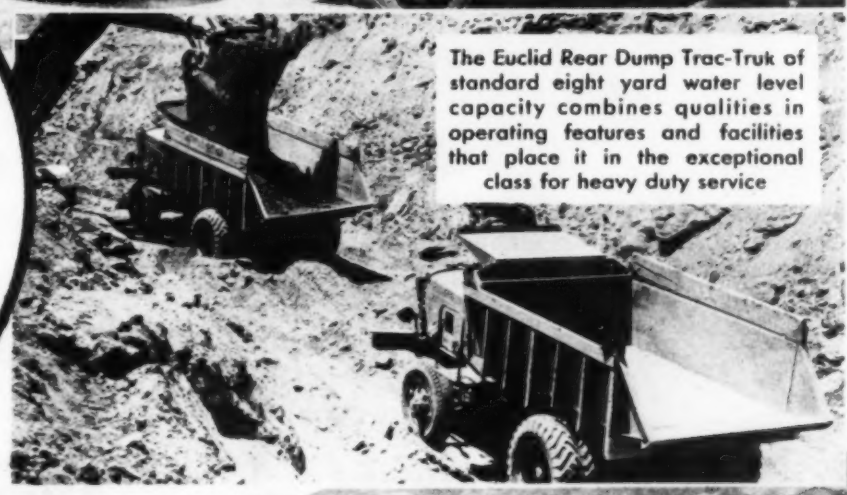
TRAC-TRUKS . . .

- TRANSPORT COAL FROM STRIP MINE TO TIPPLE
- HANDLE ROUGH HEAVY MATERIAL IN ROCK EXCAVATIONS
- MOVE ALL KINDS OF EARTH IN CONSTRUCTION WORK
- HAUL ROCK PRODUCTS FROM PIT TO PLANT

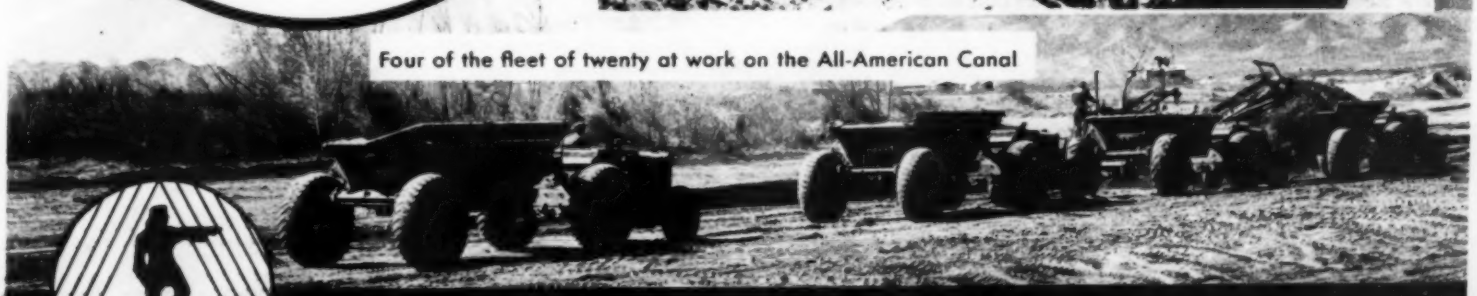
The special coal hauling Bottom Dump Trac-Truk having a 24 cu. yd. water level capacity and a rating of 20 tons

Here are illustrations of Trac-Truk selection and far reaching use for numerous kinds of construction hauling and material handling in a wide variety of applications. Their marked operation on a big scale for earth removal soon spread and expanded to include other types of hauling such as the transporting of coal and handling of rock products. In fact, this broadening use has come about, mainly, through recognition that Trac-Truks are readily adaptable to almost any hauling problem with their unusual flexibility and fast performance.

An opportunity to study and render advice on your hauling problem, without obligation, is invited



The Euclid Rear Dump Trac-Truk of standard eight yard water level capacity combines qualities in operating features and facilities that place it in the exceptional class for heavy duty service



Four of the fleet of twenty at work on the All-American Canal

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The pacemaker in
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THE most exacting basis for judging wire rope performance is AVERAGE SERVICE.
This is the basis advocated by Roebling, in which rope cost per ton of material handled, or per other unit of service measurement, is based not on the service of a single rope but on the *average* service of several ropes.
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'Incor' Saves $734 on Forms, plus $802 Heating Expense

WINTER-BUILT HEATING TUNNEL ILLUSTRATES TWO-WAY SAVING WITH 'INCOR'

NINE hundred foot heating tunnel (shown above), at Kansas City, Mo., General Hospital, was constructed in mid-winter. Department of Public Works Engineers specified 'Incor', to insure watertightness, reduce form costs, and cut heat-curing time.

Construction proceeded without interruption, in spite of below-freezing temperatures. Form cost was $416, compared to an estimated $1,150 with ordinary Portland cement. Heat savings, including labor and fuel, amounted to $802 — total saving, $1,536. Inspection shows tunnel to be watertight — 100%.

Here, as in scores of other jobs, close-figuring engineers and contractors have proved that it pays to use 'Incor' — pays, in hard, cold cash saved by this improved Portland cement which cures or hardens in one-fifth the usual time. Why not figure your next job two ways — with 'Incor' and with ordinary cement. Take all factors into consideration — see for yourself how 'Incor'* reduces the cost of forms, curing, heat-protection, labor, overhead! Made and sold by Lone Star Cement Corporation, 342 Madison Avenue, New York . . . sales offices in principal cities. *Reg. U. S. Pat. Off.

'INCOR' 24-HOUR CEMENT

SURE!

Most contractors today concede that LeTourneau equipment moves dirt cheaper than is possible by any other method. Jobs everywhere prove that. What they ask us now is: "Will Carryalls work in boulder-strewn ground?" "Will they backfill?" "Can Angledozers and Bulldozers clear trees and stumps?"

Sure! Just as jobs have proved the ability of LeTourneau equipment to move dirt cheap and quickly, so our own job experience and the job experience of hundreds of users have proved that LeTourneau Carryalls can pick up and move fairly large rock, that backfilling is no trick to the skillful operator, that Angledozers and Bulldozers can fell trees and uproot stumps, that LeTourneau's fast acting, powerful cable control enables LeTourneau equipment to do many things that to ordinary equipment are impossible. Some of these things are pictured here.

Ask your Caterpillar tractor dealer to show you what others are doing with LeTourneau equipment.

Backfilling — Contractor Roy T. Smith backfilled into a ravine with his LeTourneau 12-Yard Carryall on a W.P.A. job in Georgia. Many a LeTourneau contractor has used this method of backfilling around culverts where bulldozers were not available.

Extra Line Profitable — Harrison-Goodson, long-time Heavy user, puts top the extra line from a 2-drum Power Control Unit mounted on its Angledo equipped tractor. Many a user has found cables from the Power Control handy for this purpose and for pulling out bogged equipment.

Up and Over! — The tractor pushed forward and the powerful lever through cable control of the Angledozer lifted upward to fell this 10-in in 3 minutes on an Upper Michigan logging road.

Rock Grabber — This rock is one of many loaded by Frank Gamaldo's 8-Y Carryall on a job near Norwich, Connecticut. No other scraper has the ru carrying ability of the LeTourneau Carryall, because no other scraper has a high, wide apron lift or such a strong, double-steel bottom.

R.G. LETOURNEAU, Inc

Peoria, Illinois — Stockton, Califor

Cable address: "Bobletorno"

Manufacturers of: ANGLEDOZERS*, BUGGIES*, BU DOZERS, CARRYALL* SCRAPERS, CRANES, DRA SCRAPERS, POWER CONTROL UNITS, ROOTERS*, SE TRAILERS.

*Name registered U.S. Patent Office

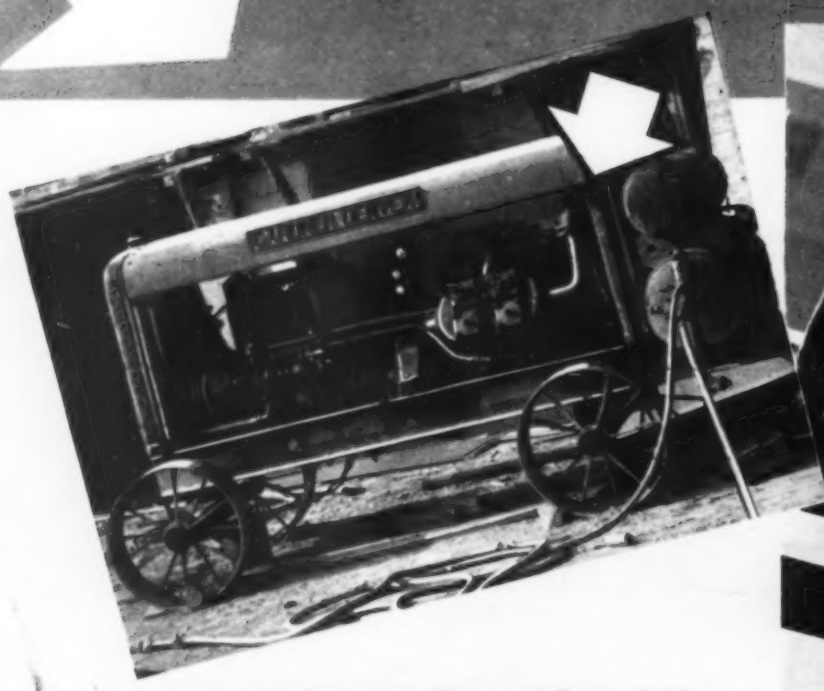
LETOURNEAU *Job Proved* EQUIPMENT

Weather and ground conditions were unfavorable—but this contract on the Tygart Dam project went through on schedule. The contractor put five sure-footed "Caterpillar" Diesel Tractors to work—and hauled his loaded wagons in tandem, licking bad grades, deep and sticky mud, and carrying full loads.

Not even adverse working conditions keep "Caterpillar" Diesels from making new records daily: hauling and bulldozing at 25 to 40% of former fuel costs; maintaining low up-keep costs even after 8000, 10,000 and more hours, living up to faster schedules than ever before possible. There's a "Caterpillar" dealer near you—he'll help you figure what "Caterpillar" Diesels can do for you. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR
REG. U. S. PAT. OFF.
DIESEL

TEXACO AT WORK



Compressors stay cleaner, more efficient with Texaco Alcaid, Algol, or Ursa Oils at work. Operating costs are lower. With these oils, hard carbon hazards are minimized. What little carbon that does form is soft, fluffy.

In EVERY FIELD, on every type of construction project, Texaco Lubricants at work have demonstrated their ability to speed up schedules, keep down costs.

A Texaco representative will be glad to provide practical engineering service to prove the economies of Texaco Products.

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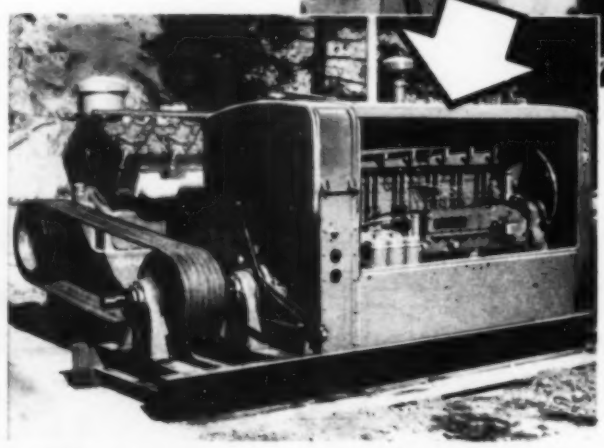


In Diesels, with Texaco Algol or Ursa Oils, rings remain active, free from hard carbon, wear is reduced. Engines hold compression, maintain higher fuel economy.

More Diesels are lubricated by Texaco throughout the whole United States than any other brand. Years of performance have proved the safety and economy of these oils in service.

There is a tested Texaco Lubricant for every type of air tool and drill . . . for every type of service, too. With these lubricants you can protect against abrasive wear, keep air tools and drills operating efficiently, save parts-replacement and repair.

TEXACO

TEXACO *Industrial Lubricants*

PUSHING AHEAD

"with a new line of tractor equipment"

EVERYWHERE . . . on different and difficult dirt-moving jobs, the modern Bucyrus-Erie Bullgraders and Bulldozers are setting new standards in performance and economy. Whether it is building a roadbed; digging an oil sump; constructing an airport; stripping in mine or quarry; or in winter snow removal work, the Bullgrader and Bulldozer stand up against the severest conditions. On every kind of job they come through with new speed, performance and profit records. Strong, balanced design; easy handling; full use of tractor power; positive, hydraulic blade action and big output capacity make these units the practical answer to today's dirt-moving problems. Write today for illustrated bulletins on the Bullgrader and Bulldozer.

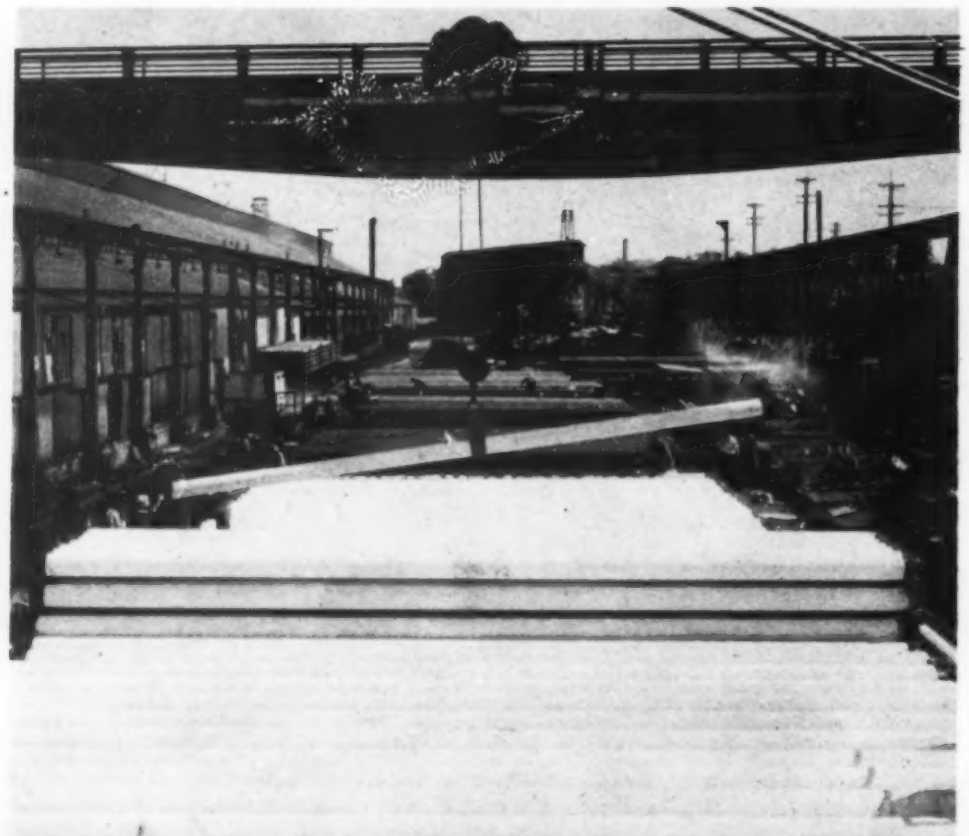
BUCYRUS-ERIE

BUCYRUS ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT . . . SOUTH MILWAUKEE, WISCONSIN, U.S.A.

Here's Pipe That

CAN GIVE IT AS WELL AS TAKE IT



Above: Ready for shipment . . . Armco Spiral Welded Pipe after helical welding by automatic precision machines.

Below: A tough layout, this, but not for Armco Spiral Welded Pipe. The ductility and flexibility of this strong, easy-handling pipe makes for easy going over any kind of terrain.

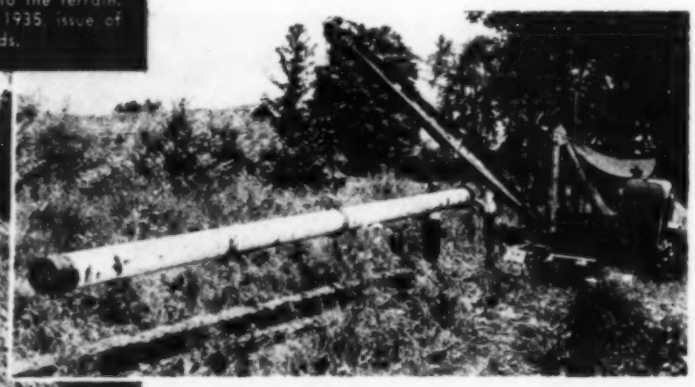
Right: In Palmyra, New York Armco Spiral Welded Pipe cut costs through easier handling and ready adaptability to the terrain. See the November, 1935, issue of Construction Methods.

THERE has been a lot of talk about pipe that can take it. Now let's talk about *giving it* as well as taking it, because ARMCO Spiral Welded Pipe "goes to town" on both scores.

Here are some of the advantages it gives . . . Peak flow capacity induced by smooth inner walls . . . great strength combined with exceptional ductility . . . economical permanence based on generous performance before replacement . . . utmost service and safety per dollar of cost.

And that's not all: ARMCO Spiral Welded Pipe, as sturdy and serviceable as it is, is relatively light and trim. Long, accurate lengths that go together tightly mean low leakage loss. Service interruptions are mighty few.

The sizes are 6-inch to 36-inch. Wall thicknesses run from 12-gage to ½ inch, lengths up to 40 feet. You can use any common joint, and specify the pipe in durable ARMCO Ingot Iron or Steel. Any regular or special fittings can be provided, and the coatings are optional.



★

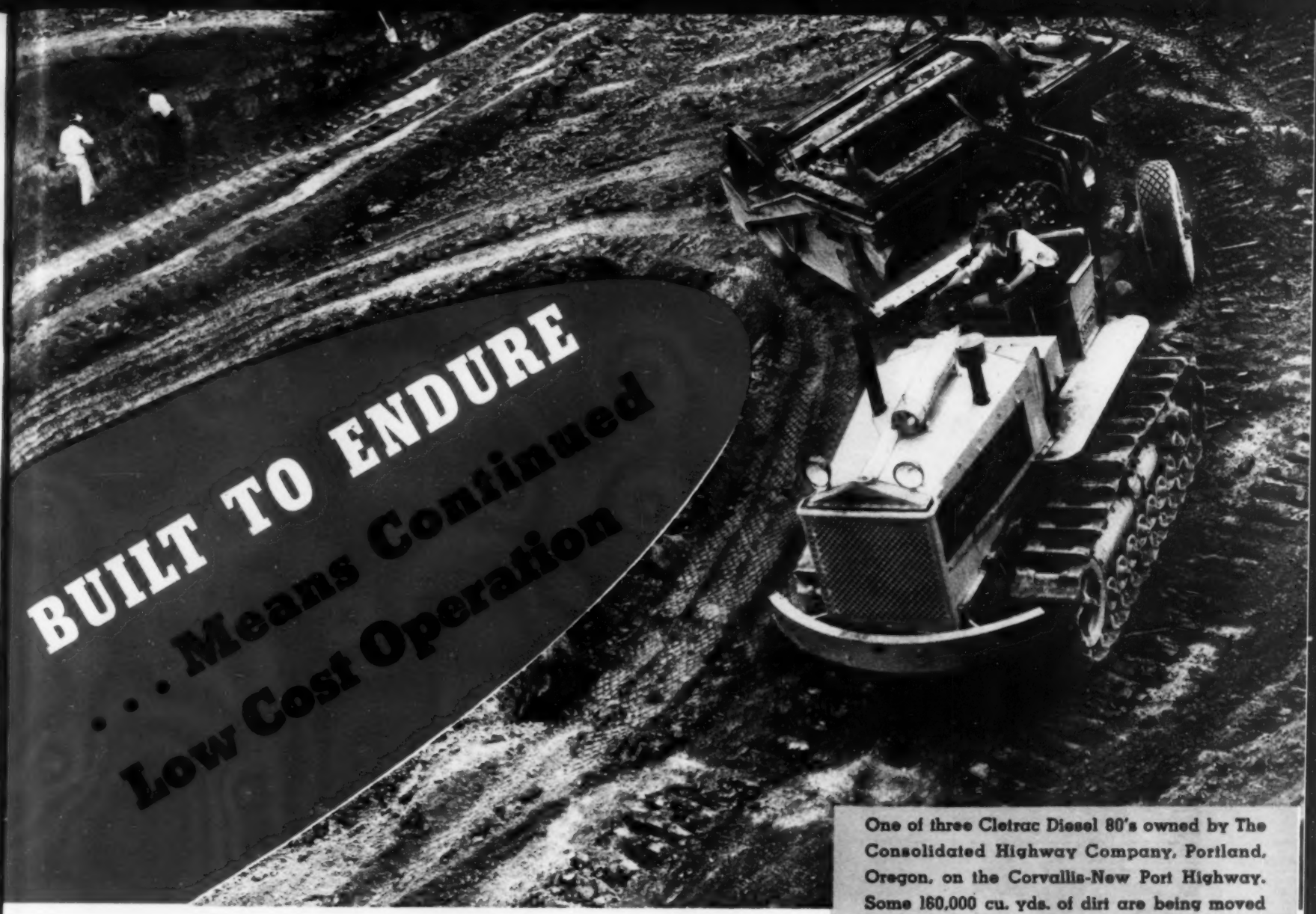
USE
ARMCO SPIRAL WELDED
FOR

Heavy-wall permanent jobs
Light-wall temporary jobs
Dredge pipe installations (special analyses steel walls)
Air-pipe installations
Special industrial piping

★

Invest your pipe dollars in ARMCO Spiral Welded and bid good-bye to installation and service troubles. Shall we send you complete information? The American Rolling Mill Company, Pipe Sales Division, Middletown, Ohio.

ARMCO SPIRAL WELDED PIPE



One of three Cletrac Diesel 80's owned by The Consolidated Highway Company, Portland, Oregon, on the Corvallis-New Port Highway. Some 160,000 cu. yds. of dirt are being moved with Cletracs and 12-yd. Isaacson Scrapers.

CLETRAC STEERING

. . . means more for your money

LONG YEARS of engineering experience, fine steels, expensive heat treating and precision workmanship are all built into Cletrac Crawler Tractors to reduce wear, increase life and give you more for your money.

Fully as important are features of construction that stop wear before it starts, make for easier operation and reduce operating costs.

Cletrac steering, for instance, is different. Shocks and strains which lead to costly maintenance and replacement of steering and driving mechanism are eliminated. Power is never disconnected from either track in turning and steering is the same on turns, side-hills or down-hill under load. Power on both tracks at all times means handling larger loads on turns. Cletrac steering is simple, easy and effective.

Do you *want* more for your money? We will gladly show you how Cletrac Crawler Tractors give it to you.

You'll want to know more about

- CLETRAC CONTROLLED DIFFERENTIAL STEERING
- CLETRAC PATENTED ONE-PIECE DROP FORGED TRACK SHOE CONSTRUCTION
- CLETRAC ACCESSIBILITY
- CLETRAC'S SIMPLE, EASY STARTING

And many other Cletrac features that are worth while to any Cletrac owner. Write for further information regarding Cletracs and the application of Cletrac crawler power to your job.

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Gas or Diesel crawler tractors in a full range of sizes for every use from 22 to 94 horsepower.

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Crawler Tractors
Built To Endure

THE CLEVELAND TRACTOR CO.
CLEVELAND, OHIO

A PERFECT FIT
Whatever the job

HERE are the machines you can drop into any hole calling for a 3/8 or 1/2 yd. shovel, crane or dragline.

They bring you complete versatility—complete convertability.

What type of machine means the greatest possible profit on your job—a crawler shovel today, a crawler crane tomorrow—a Truck Crane or Shovel next month? You can have it with an ease never before possible.

Models 15, 3/8 yd. Northwests and Model 18, 1/2 yd. Northwests are easily converted from shovel to crane or dragline and vice versa by simply changing booms. But more than that they can be removed from their crawler mechanism with almost equal ease and mounted on a truck for truck crane or shovel service.

If you contemplate the purchase of a small capacity machine be sure to check on all the advantages of a Northwest before you buy.

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1728 Steger Building, 28 E. Jackson Blvd., Chicago

MODEL 15 3/8 YARD
MODEL 18 1/2 YARD
RIGHT TO YOUR JOB . . .
AT MOTOR TRUCK SPEED
Northwest Models 15 and 18 can also be supplied with a trailer mounting for fast transport behind a truck.
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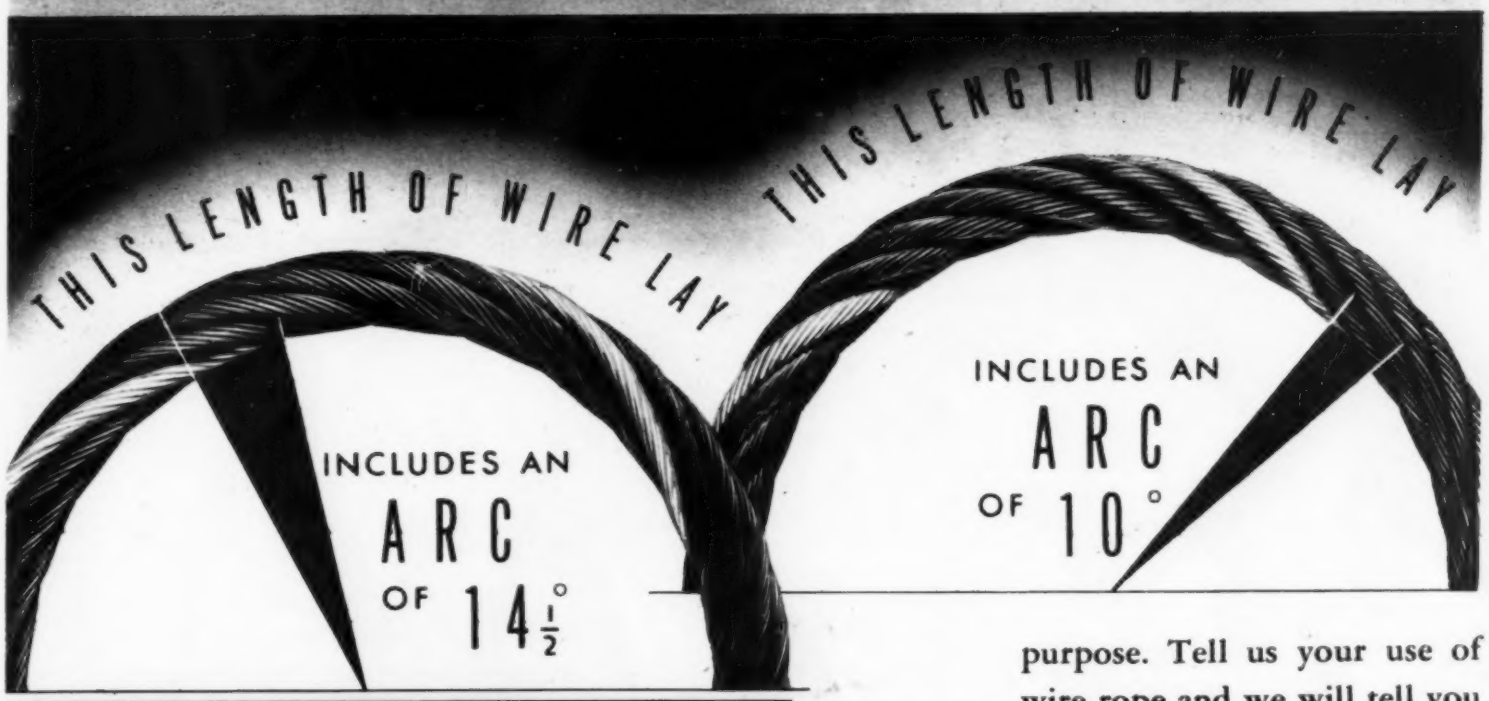

Select the Rope that Fits Your Job

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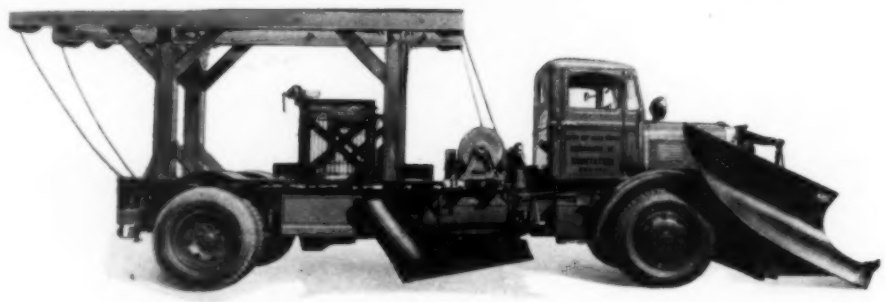

● The wrecker truck, like this one of twenty on a regular beat in New York City, does a giant's job every day. Its makers, Four Wheel Drive Auto Co., Clintonville, Wis., built it to stand overloading as regular routine. Wherever shock and fatigue strike hardest, this firm uses Nickel Steels: In axle differential gears and drive shafts, Nickel-molybdenum steels corresponding to SAE 4615 and 4340. In other highly stressed parts, other Nickel and Nickel-chromium steels assure the needed reserve of strength.

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for 1937

Koehring announces another new model for 1937. Modern equipment for high speed operation is the difference between profit and loss . . . The new Koehring has enclosed gears, anti-friction bearings, and selective swing speed — for lower upkeep cost, faster and simpler operation and for greater yardage. One yard capacity as a shovel — yard and a quarter for dragline, or a crane.

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Full power at the blade, fast accurate hydraulic controls are just two of the many reasons for the Austin-Western Motor Grader's extra performance.

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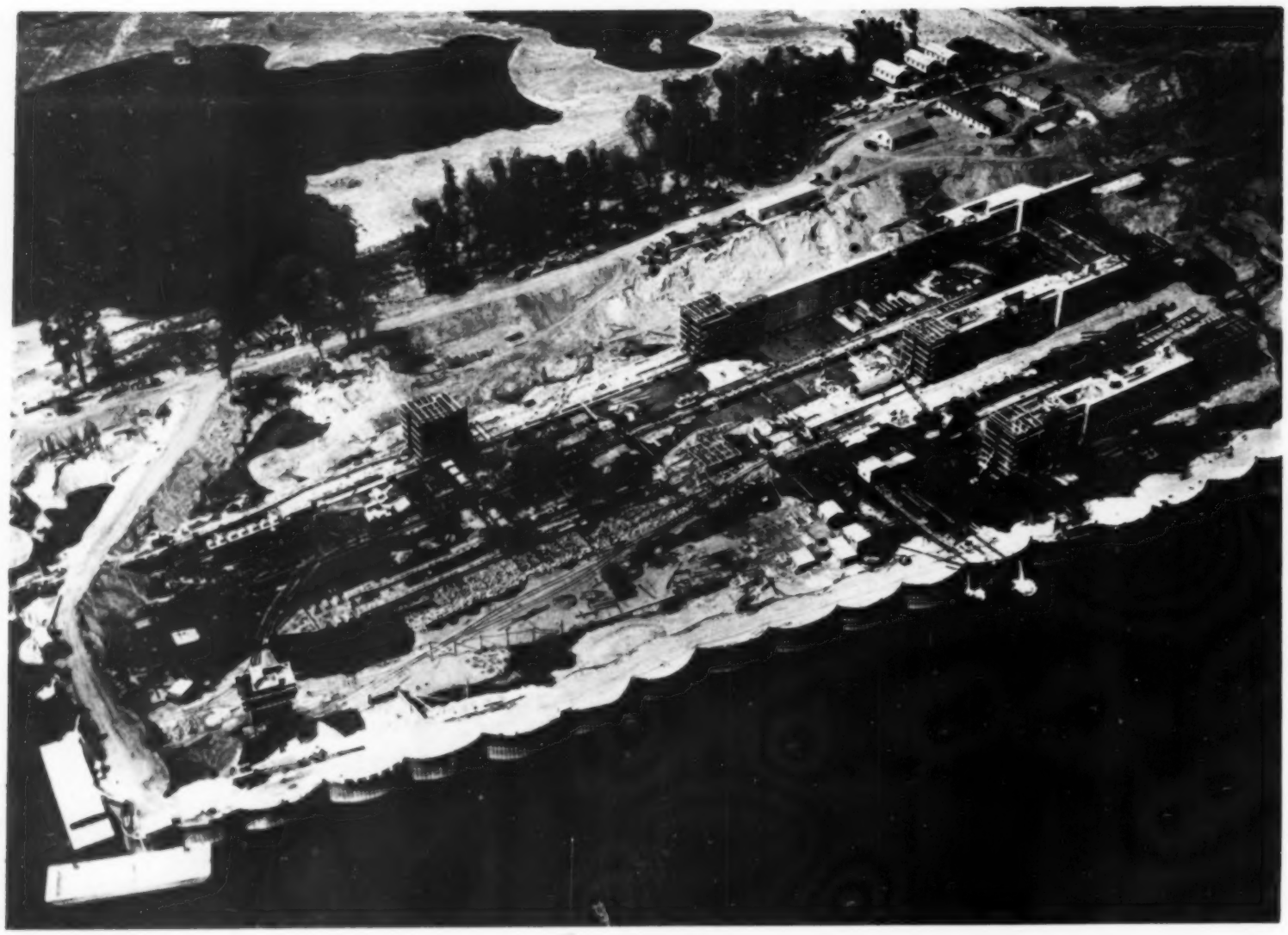

Inland Piling at Lock 25 On The Mississippi

Above: Construction photo of Mississippi Lock No. 25 at Cap Au Gris, Missouri. 2751 tons of Inland Section I-23 was used, some of the piles being 65 feet long.

This is the latest aerial photograph of the construction work underway on Lock No. 25 at Cap Au Gris on the Mississippi River.

The view clearly shows the neat tight job of Inland Steel Sheet Piling installed by the United Construction Co. United reports everything going well and work progressing splendidly.

This is but one of many successful Inland Piling jobs on the Mississippi. But Piling is only a part of the picture, for Inland Engineers work closely with the contractors from beginning to end, co-operating on design, method and construction until the job is completed.

We invite you to call an Inland Engineer on your next Piling or other construction job—for Inland Service will prove definitely helpful to you.

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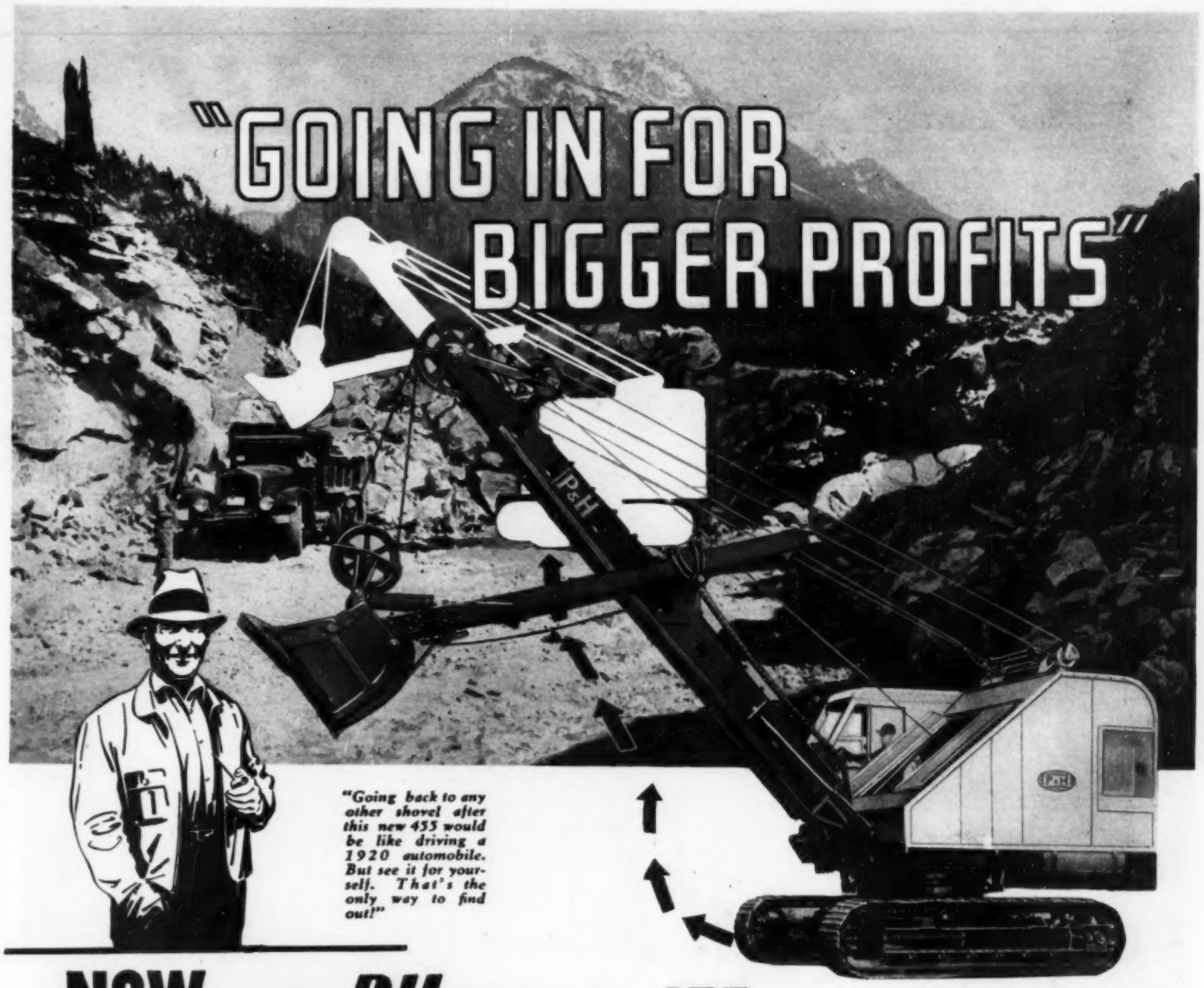

"Going back to any other shovel after this new 455 would be like driving a 1920 automobile. But see it for yourself. That's the only way to find out!"

NOW THE P&H MODEL 455 STEPS AHEAD IN THE 1-YD. CLASS

Any production-minded contractor who sees the new 455 in action knows what's happening in the excavator business. The days of hulky cast machinery are numbered! Now it's speed—speed in getting to the job—in getting through with it and on to the next job. It's the ability to earn faster. The new 455 has it!

A penny postcard is all it takes to bring your copy of this new bulletin X-11. Send for it today.

THE ONLY 1-YD. MACHINE WITH ALL THESE NEW HIGH PRODUCTION FEATURES

1. ***Greatly improved traction.*** The first time on a 1-yard machine—tractor-type crawlers with compensating springs and tough rolled steel shoes.
2. ***Huskier frame of alloy steel, all welded.*** Lighter, far stronger; cross-braced with rolled steels of uniform strength to minimize tendency to "weave".
3. ***Smoother action with helical cut gears.*** 100% helical gearing in the hoist mechanism; three teeth enmesh at all times. Fully enclosed in oil bath.
4. ***Faster swing on a live roller circle.*** Fast, full-loaded swings are safe on this huge roller bearing. Six hook rollers relieve center pin of all strain.

Then, remember—in this new 455, there's huskier Diesel power—live boom that adjusts to any working angle—split-second power clutches—two speed transmission for every movement—automotive-type foot pedals and lightly manipulated levers; so simple to run that any operator at the controls of this new Pacemaker becomes a star operator. Prove it to yourself!

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Construction Methods
AND EQUIPMENT

ROBERT K. TOMLIN, Editor

Volume 18 Number 12.
December, 1936

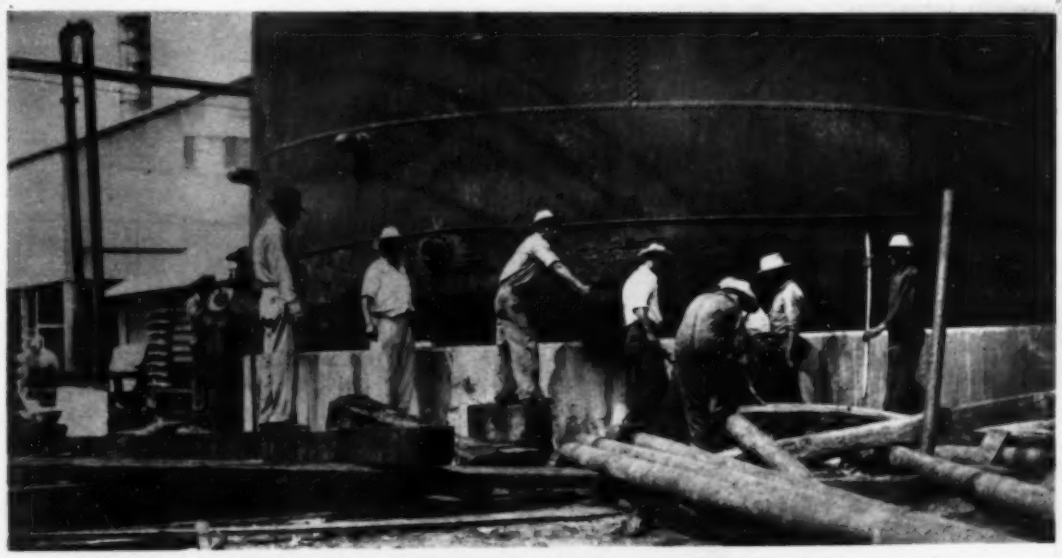
MELTING ICE CAKES lower 2,500-bbl. asphalt tank uniformly on to new elevated foundations 3 ft. above ground level.

ICE CAKES

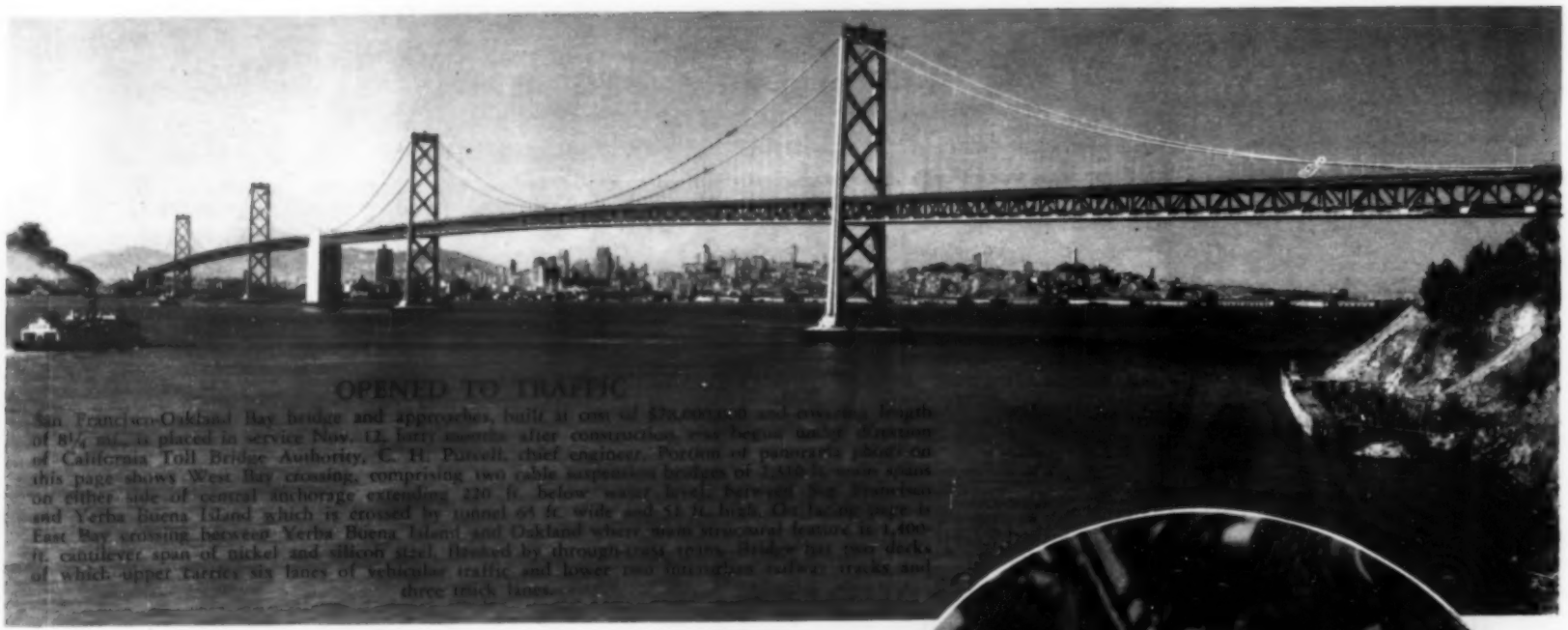
Lower 40-Ton Asphalt Tanks

BY UTILIZING the uniform melting and compressive strength of ice, the Pierce Oil Co. lowered three 2,500-bbl. asphalt tanks weighing 40 tons each on to new concrete foundations at Tampico, Mex., without the use of jacks, which would have required jack holes in the concrete or jacking lugs on the tanks. Compressive strength of the artificial ice used was computed at 7 tons per square foot, requiring 6 sq.ft. to support a 40-ton tank. As a factor of safety and precaution against slipping, wood blocks used on the foundation in conjunction with the ice were not entirely removed until the center of the tank had come to rest on the concrete base.

Each tank was jacked up on cribbing and moved on rollers into position above its new foundation, where blocks of ice 1 ft. thick were placed under it. The blocks supporting the tank melted in about 2 hr. at an air temperature of 80 deg. F., lowering the tank uniformly over its entire circumference. Raising of the three tanks was carried out to provide for gravity filling of barrels from the tanks. F. D. Smith, chief engineer of the Pierce Oil Co., directed the work.



AFTER BEING ROLLED to new position above concrete foundations, tank is supported on wood blocks until ice can be placed for lowering.



OPENED TO TRAFFIC

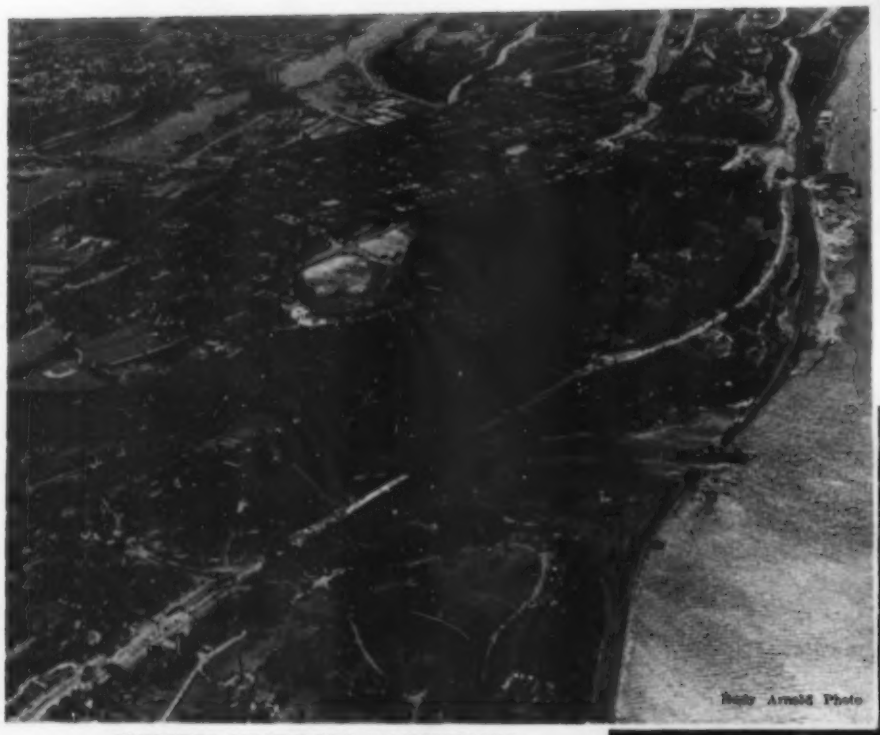
San Francisco-Oakland Bay bridge and approaches, built at cost of $78,000,000 and covering length of 8¼ mi., is placed in service Nov. 12, forty months after construction was begun under direction of California Toll Bridge Authority, C. H. Purcell, chief engineer. Portion of panorama photo on this page shows West Bay crossing, comprising two cable suspension bridges of 2,310-ft. main spans on either side of central anchorage extending 220 ft. below water level, between San Francisco and Yerba Buena Island which is crossed by tunnel 76 ft. wide and 58 ft. high. On facing page is East Bay crossing between Yerba Buena Island and Oakland where main structural feature is 1,400-ft. cantilever span of nickel and silicon steel, flanked by through-truss spans. Bridge has two decks of which upper carries six lanes of vehicular traffic and lower two interurban railway tracks and three truck lanes.

This Month's

"NEWS REEL"

LAST RIVET

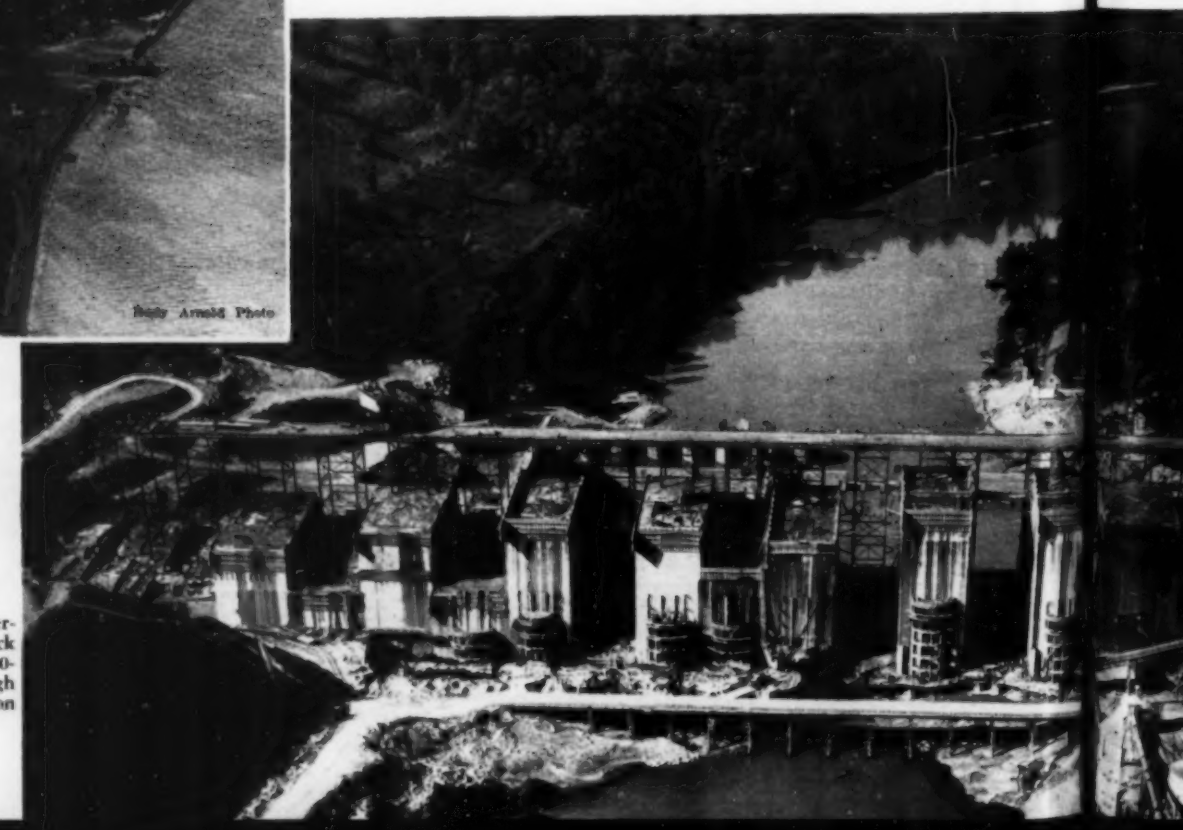
on steel superstructure of San Francisco-Oakland Bay bridge is driven by C. H. Purcell (with gun) chief engineer, and Charles E. Andrew, bridge engineer.



Ruth Arnold Photo

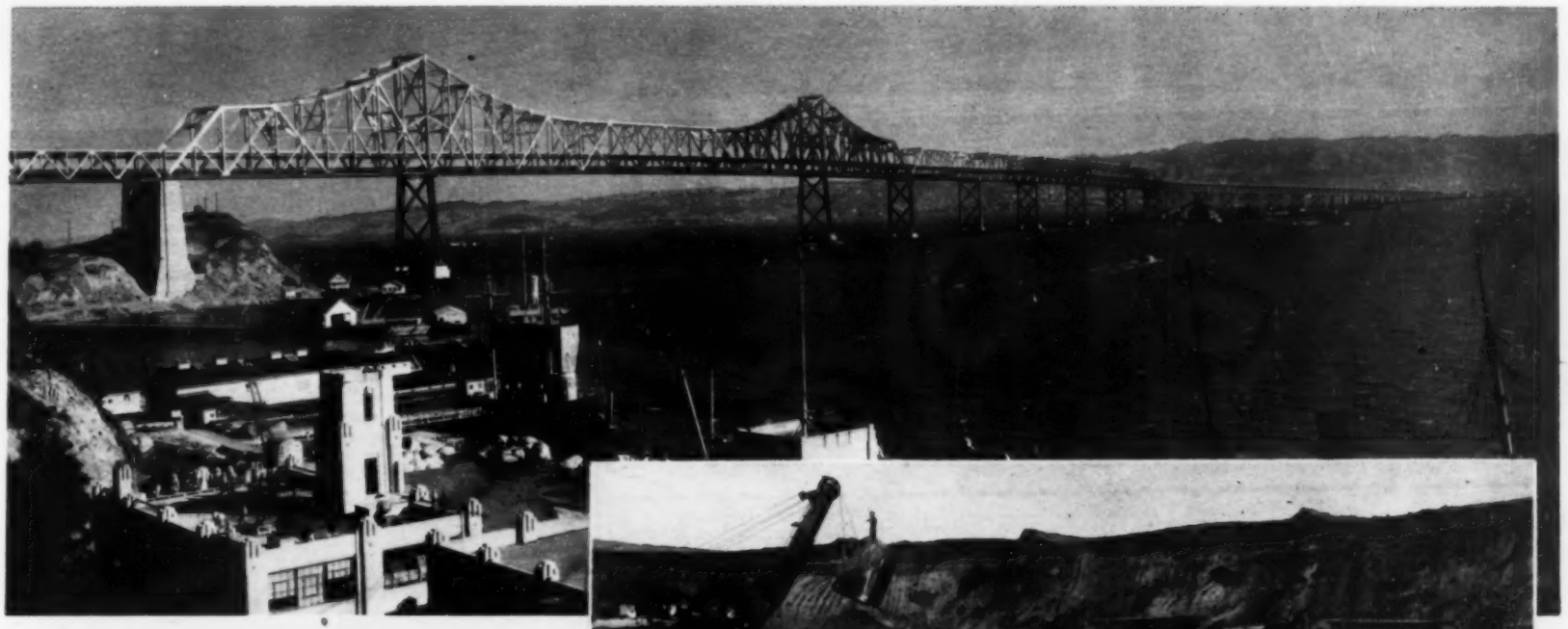
HENRY HUDSON PARKWAY

linking Riverside Drive (in upper right background) on Manhattan Island with Westchester County parkway system will be opened to traffic this month. Four-lane roadway crosses Harlem River on world's longest fixed arch and longest plate-girder arch, with span of 800 ft. Erection of bridge is described elsewhere in this issue.



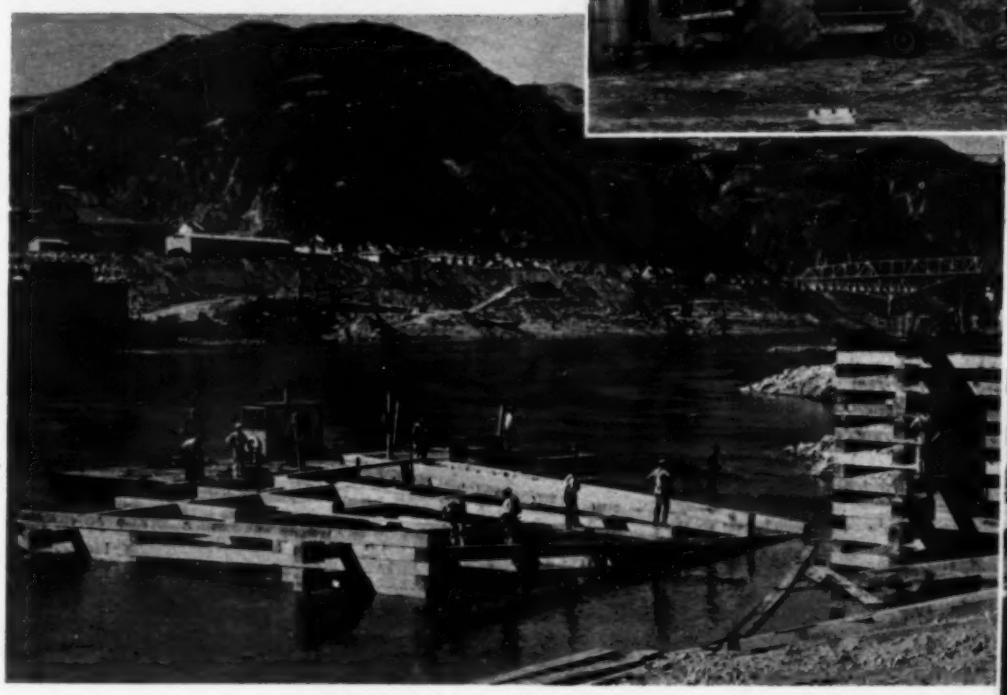
TYGART DAM

(right) takes form near Grafton, W. Va., under supervision of U. S. Engineer Department, as Frederick Snare Corp., New York contractor, nears 1,000,000-cu.yd. mark in concreting main body of 225-ft. high structure, using three Whirley cranes operating on steel trestles embedded in dam as concrete rises.



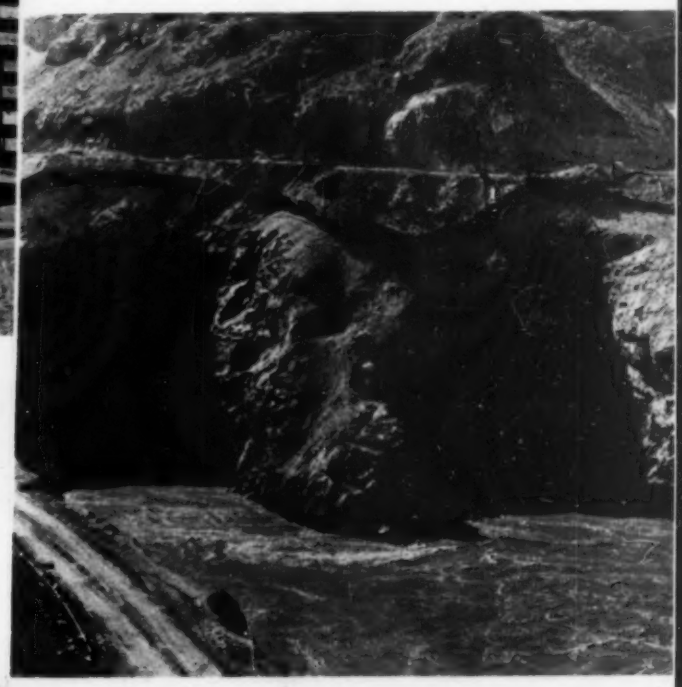
CASPER — ALCOVA PROJECT

(above) progresses on North Platte River, Wyoming, as earth moving fleet of George W. Condon, contractor of Omaha, Neb., comprising 11 Allis-Chalmers tractor-hauled, 6-9-cu.yd. Speed Ace wagons, places 1,200,000 cu.yd. of fill at Alcova dam. With haul of ¾-1 mi., these units make 40 round trips in 7-hr. shift and are operated 21 hr. per day.



DIVERSION OF COLUMBIA RIVER

(above) is begun to permit construction of central section of Grand Coulee dam in Washington. Section of wood cribbing for new cofferdam is being floated to place by crew of Mason-Walsh-Atkinson-Kier Co., contractor for U. S. Bureau of Reclamation. Cofferdam will turn river through low section of west abutment of dam.



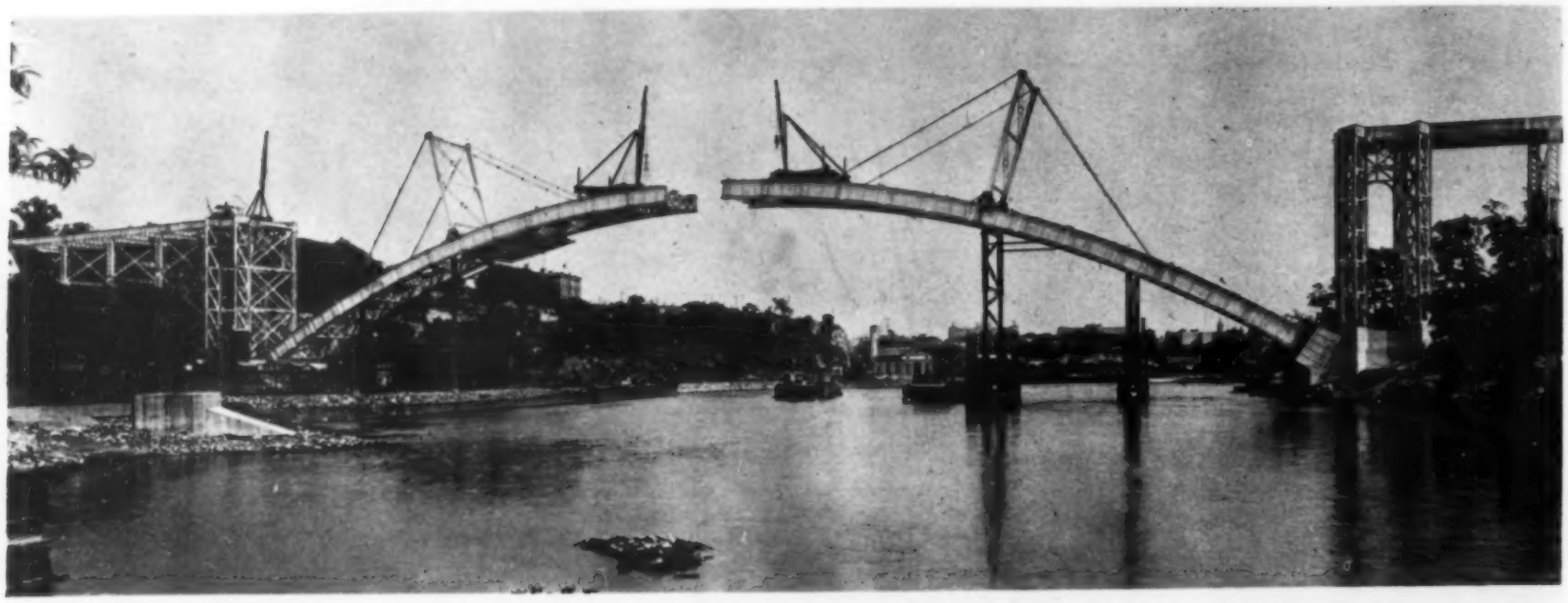
COLORADO RIVER BYPASSED

through 29-ft.-diameter diversion tunnels 1,730 ft. long at Parker dam preparatory to start of excavation for foundations by J. F. Shea Co., subcontractor for Six Companies Inc. Dam, when completed, will divert water from river into Colorado River aqueduct serving southern California. Operations were directed by Frank Crowe, who served as general superintendent on construction of Boulder dam.

Wide World Photo

CORNER STONE LAID

(left) for Ten Eyck housing project in Brooklyn, N. Y., one of the larger projects of PWA's Housing Division, to provide 1,614 living units in 4-story walk-up apartments covering 26 acres. Contractors, Starrett Bros. & Eken, Inc.; architect, R. H. Shreve. U. S. Senator Robert F. Wagner wields trowel as chairman Langdon W. Post, of N. Y. Housing Authority and Mayor F. H. LaGuardia look on.



WORLD'S LONGEST FIXED ARCH approaches closure as two cantilevered arms stretch forward to center of 800-ft. span above Harlem River.

JACKING DEVICES

Control Rib Stresses During Erection and Closing of 800-FT. HINGELESS ARCH

Kris J. Haker Photos

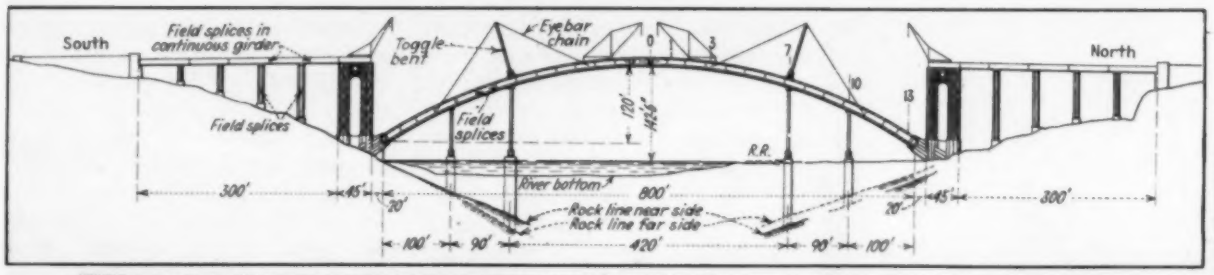
ADJUSTABLE STEEL FALSEWORK BENT which can be raised or lowered by pairs of hydraulic jacks at bases of columns supports arch ribs at panel point 10S as traveling derrick erects successive sections toward center of span. Powerful floating derrick places 140-ton steel cage in river to serve as guide and bracing frame for H-piles which will be driven to rock to provide unyielding foundation for bent 7S.

OUTSTANDING as the longest fixed arch and the longest plate girder arch in existence, the 800-ft. main span of the Henry Hudson bridge across the Harlem River made exceptional demands upon the American Bridge Co., contractor, both in precision of fabrication and in control of stresses during erection of the ribs. Various jacking devices enabled the contractor first to erect the two halves of the arch by cantilever methods without overstressing the ribs and later to open the two arms at the crown to proper position for insertion of the closing piece.

Rib sections received accurate milling and matching in a progressively extended assembly in the shop prior to shipment to the job. The actual span length was measured in the field between grillages set permanently in place in the main piers. As a final compensator to take care of variations in the span length and also in the length of the sections, amounting to less than 1 in. for the entire arch, the closure piece was not machined until all rib sections had been assembled in the shop and the actual length of the complete assemblies measured.

Arch Ribs — Two ribs on 50-ft. centers support the spandrel bents and steel and concrete deck of the bridge, which for the present carries a four-lane concrete roadway and one 4-ft. sidewalk. Provision is made in the design for later addition of a second deck when traffic warrants it. Each rib of the arch is made up of two silicon steel plate girders 12½ ft. deep on 3-ft. 8-in. centers, laced top, bottom and center. Each plate girder has eight flange angles arranged four at the top and four at the bottom.

Erection Procedure — Cantilever erection was made necessary by traffic arteries under the bridge, which crosses



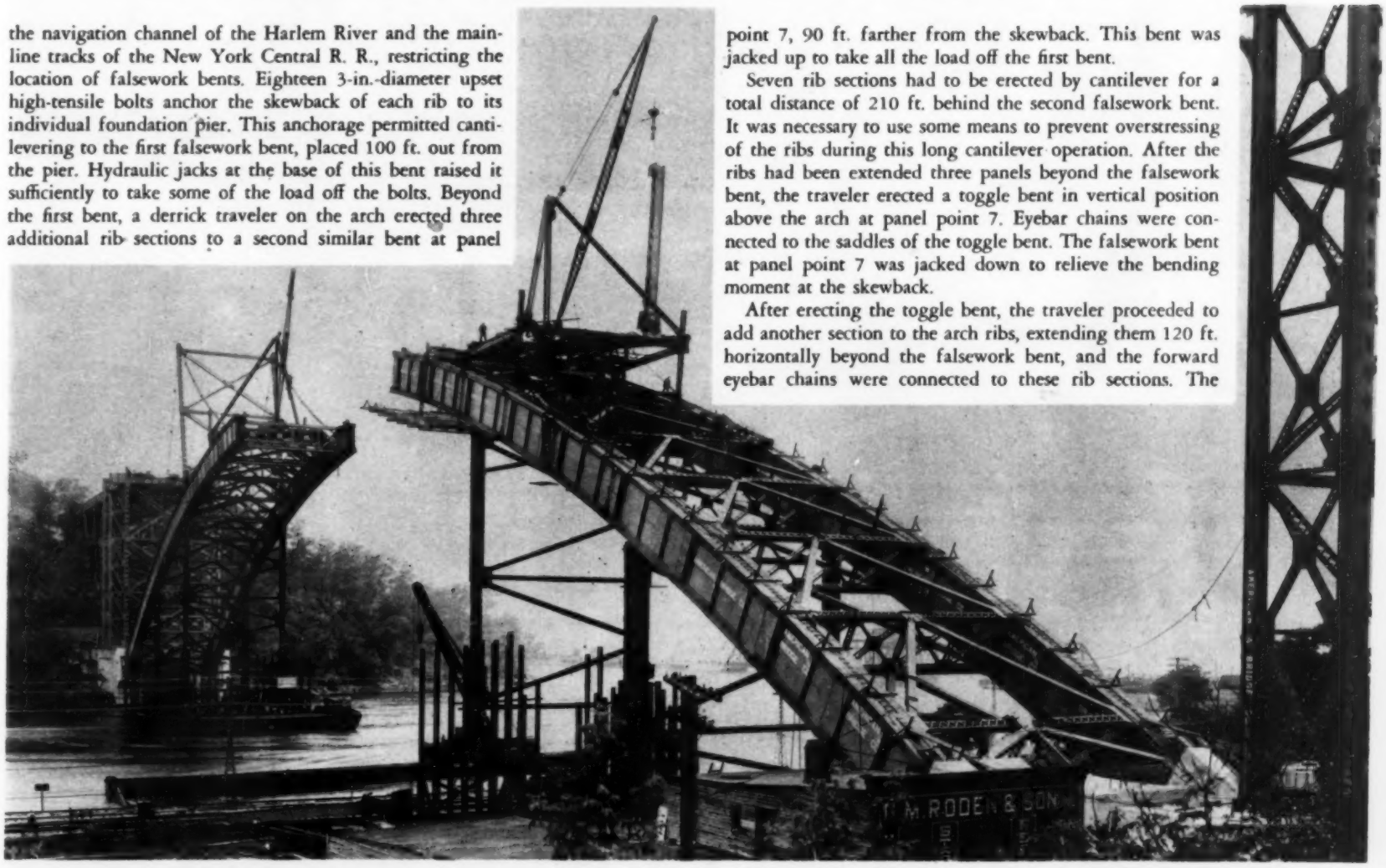
Kric J. Baker Photos

WITH RIBS CANTILEVERED beyond falsework bent at panel point 7, arch traveler erects toggle bent on arch at this point, utilizing steel intended eventually for permanent spandrel bent 13 of bridge superstructure. ERECTION PROCEDURE *(in drawing, above)* involves use of adjustable falsework bents at panel points 10 and 7, N and S, to reduce bending moment at skewback. As two halves of arch approach center of span, toggles made up of steel-column bents and eyebar chains are brought into play, reducing bending moment in arch ribs.

the navigation channel of the Harlem River and the main-line tracks of the New York Central R. R., restricting the location of falsework bents. Eighteen 3-in.-diameter upset high-tensile bolts anchor the skewback of each rib to its individual foundation pier. This anchorage permitted cantilevering to the first falsework bent, placed 100 ft. out from the pier. Hydraulic jacks at the base of this bent raised it sufficiently to take some of the load off the bolts. Beyond the first bent, a derrick traveler on the arch erected three additional rib sections to a second similar bent at panel point 7, 90 ft. farther from the skewback. This bent was jacked up to take all the load off the first bent.

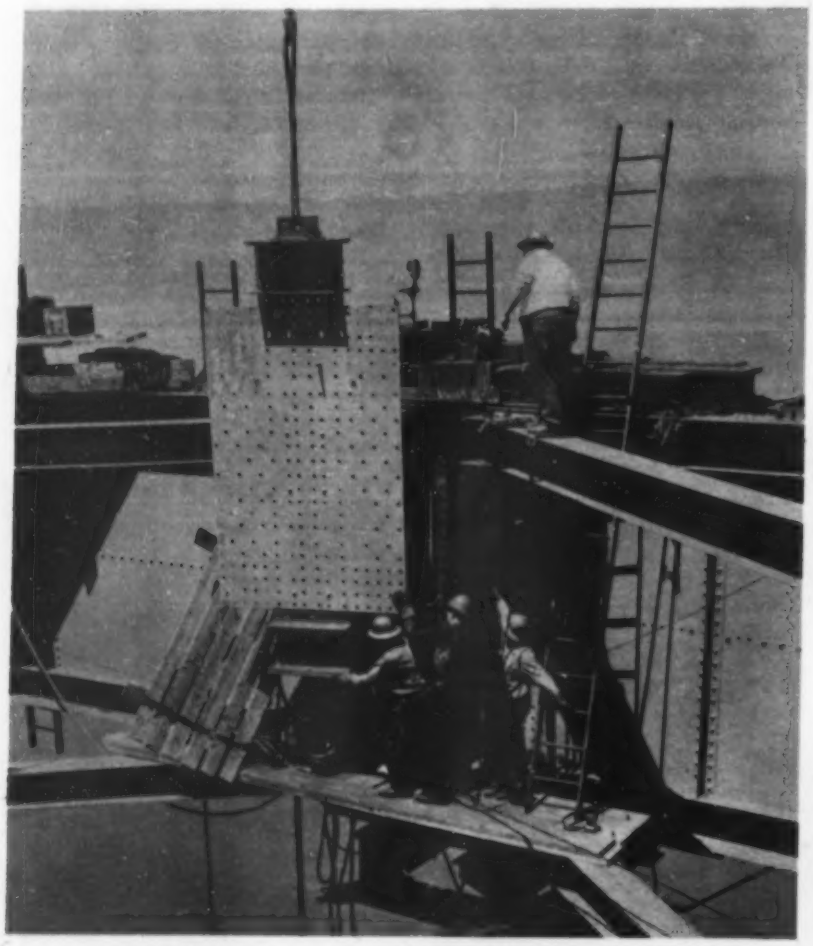
Seven rib sections had to be erected by cantilever for a total distance of 210 ft. behind the second falsework bent. It was necessary to use some means to prevent overstressing of the ribs during this long cantilever operation. After the ribs had been extended three panels beyond the falsework bent, the traveler erected a toggle bent in vertical position above the arch at panel point 7. Eyebar chains were connected to the saddles of the toggle bent. The falsework bent at panel point 7 was jacked down to relieve the bending moment at the skewback.

After erecting the toggle bent, the traveler proceeded to add another section to the arch ribs, extending them 120 ft. horizontally beyond the falsework bent, and the forward eyebar chains were connected to these rib sections. The



ARCH TRAVELER on near (north) side of river sets first column section for toggle bent. On far side of river forward eyebar chains of toggle already have been connected to ribs cantilevered 120 ft. beyond falsework bent 7S. Traveling derricks are driven from hoist engines on ground. Rear supporting posts of traveler are adjustable to permit leveling of derrick sills at each position on arch. By special jacking arrangement load on derrick boom is transferred to trussed cross-strut between arch ribs, eliminating need for heavy transverse member at forward end of traveler.

BEVELED BLOCKING SHIMS driven tight in shim piles paralleling jacks at crown permit close following of jacking during process of opening gap to receive closure piece. D. M. Wood, superintendent, American Bridge Co., watches pressure gage at his left.

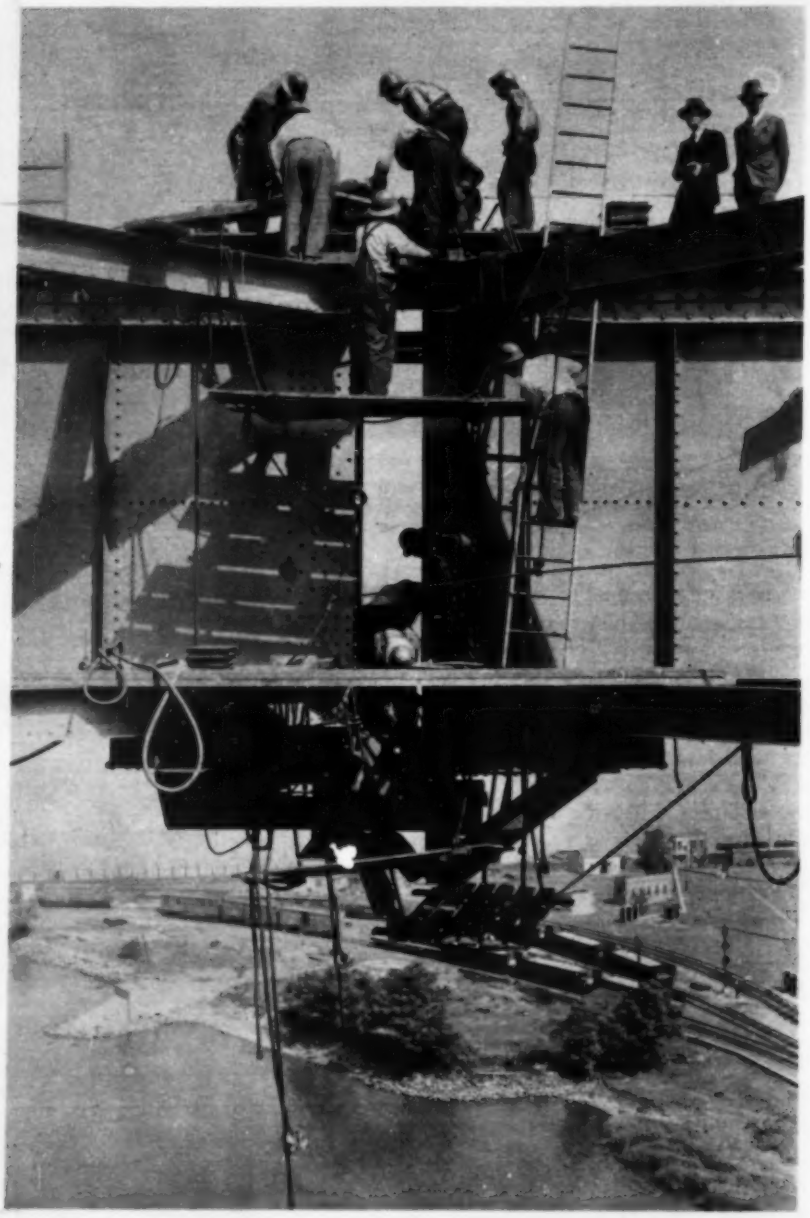


CLOSURE PIECE with outside web splice plate attached is hoisted for insertion in girder of rib. Inside web splice plate, shipped in retracted position inside rib, already has been placed across opening and pinned on one side. Closure piece will be pinned and bolted on one side of opening prior to release of jacks. When release of jacks puts piece in bearing, pinning and bolting of center splice will be completed on other side of opening.

toggle bent then was tipped back and the rear eyebar chains connected to the arch ribs between the toggle bent and the skewbacks. After the ribs had been cantilevered to the center of the span, the toggle bents were jacked up or down to put the ribs in perfect alignment for the erection of jacking equipment and guides at the crown.

Closure Operations — Cantilever erection of the ribs on the two sides of the river proceeded simultaneously. The ribs were erected a little below their final position to reduce the loads on piers, falsework bents and toggles.

Crown jacks and blocking shims were placed outside the rib flanges to avoid interference with insertion of the closing piece. Upper and lower jacks were interconnected and operated from the same pump. Beveled shims were used to keep the load on the jacks in line with the plunger as the angle of the crown opening changed. As a further protection against eccentric loading, shims with a bearing area 6 in. wide at the center of the jack were inserted in the shim piles. Beveled blocking shims which could be driven tightly into shim piles paralleling the

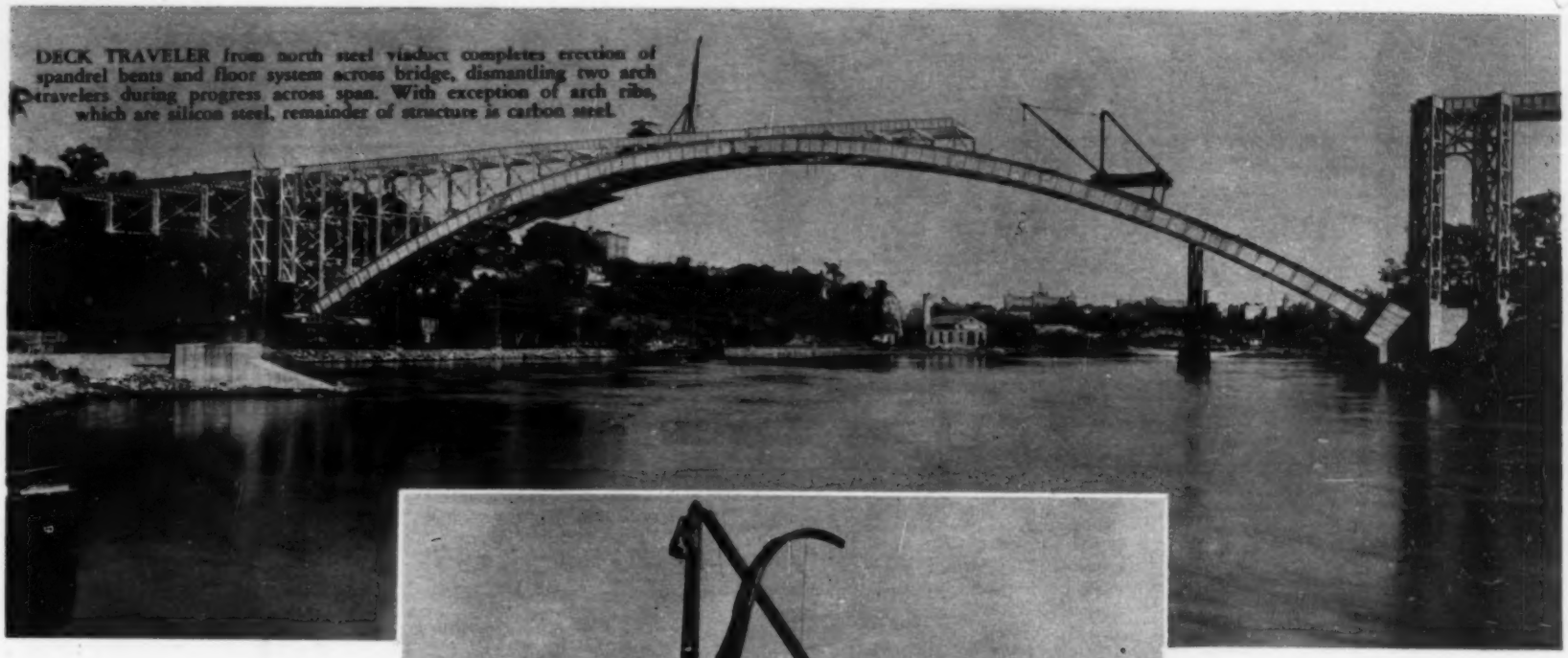


JACKS AT CROWN, supported one above upper flange and one below lower flange of rib, open 2½-ft. gap between cantilever arms to receive closure piece. Spreading arms at crown raises ribs about 4½ ft. from erected to final position. This raising is assisted by jacks under falsework bents 7N and 7S.

When extended to the center of the span, the arch ribs were about 4½ ft. below final position, and the ends of the ribs were about 6 in. apart. Jacks at the crown spread the opening to about 30 in. to receive the closing piece, as shown in several of the photographs. Spreading the crown opening caused the ribs to rise to their proper position. Jacks under the falsework bents assisted in the raising to avoid excessive loads on the crown jacks.

jacks, permitted close following of the jacking as the opening increased. Guides maintained vertical and horizontal alignment during the jacking.

At a normal temperature of 55 deg. F., the crown jacks carrying the load alone would have been loaded to about 1,200 tons per rib. Temperature has a marked effect on the jacking load. On July 8, when closure was made, temperatures up to 90 deg. F. prevailed. Work started at 5 a.m., and closure

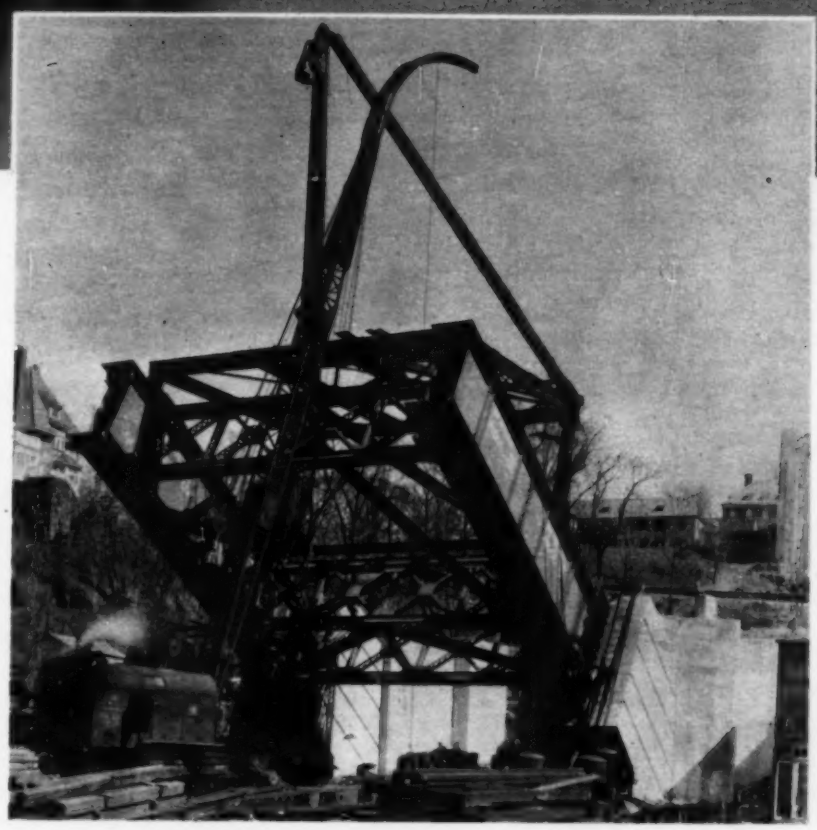


DECK TRAVELER from north steel viaduct completes erection of spandrel bents and floor system across bridge, dismantling two arch travelers during progress across span. With exception of arch ribs, which are silicon steel, remainder of structure is carbon steel.

of the arch was completed at 2:30 p.m.

As the first step in the operation the crown jacks were jacked up to 1,000 tons per rib, equal to 9,000 lb. per square inch for each jack. Bents 7N and 7S then were raised ½ in., the crown jacks being maintained at 9,000 lb. per square inch. After another ½-in. rise at the bents, the raising proceeded in .1-in. increments up to 12 in., the crown jacks being kept at 9,000 lb. per square inch. The theoretical ratio of 1⅜-in. movement at the crown for each 1-in. rise at the bents was realized almost perfectly. To obtain the full opening of 2½ ft. plus ¾-in. clearance at the crown, it was necessary three times to decompress the jacks and place backup shims. Each time the beveled shims were changed as required to compensate for the change in angle between the ribs.

By 11 a.m. the load had been transferred to the blocking shims, and the opening was ready for the closure piece. Closing pieces and web splice plates were placed and bolted on one side of the opening. The jacks at the crown and at bents 7N and 7S then picked up the load again and were slacked off to bring the closing piece into bearing. At 2:30 the arch was closed, creating a fixed arch span, and the other side of the center splice was bolted and pinned. Finally, bents 7N and 7S were jacked down, transferring the load entirely to the main piers.



SKEWBACK OF EACH RIB is anchored to foundation pier by eighteen 3-in. diameter high-strength bolts 30 ft. long. Skewback has 4-in. base billet bearing on grillage 6 ft. deep (incased in concrete) with 4-in. base billet 20x14-ft. in area. Ribs are each made up of two silicon steel plate girders 12½ ft. deep and 3 ft. 8 in. o.c., laced top, bottom and center. Locomotive crane erects rib sections out to bent 10 on north side and assembles arch traveler on ribs.

Administration—The Henry Hudson bridge is a part of the Henry Hudson Parkway being built to connect Riverside Drive, Manhattan, with the Saw Mill River Boulevard Extension, in Van Cortlandt Park, Borough of the Bronx. To carry out this improvement, the Henry Hudson Parkway Authority was created by act of the New York State legislature. Robert Moses is the sole member of the Authority.

Madigan-Hyland are engineers in charge of construction for the Authority. Robinson & Steinman are consulting engineers on the bridge. The American Bridge Co. is the contractor for the superstructure.

Eric J. Baker Photos

TWO HALVES of 800-ft. arch are erected below final position to reduce loads at bents and piers. When erected to center of span, ends of ribs are about 6 in. apart and 4½ ft. below final position. During closure operation jacks at crown increase opening to 2½ ft. and raise ribs 4½ ft., assisted by jacks at falsework bents under toggle bents. Arch travelers raise closure pieces from car ferry in river.

SPILLWAY EXCAVATION at west or right abutment of dam. Material cast down steep slope is loaded into trucks by power shovel.

FROM UPSTREAM SIDE of dam, showing rock fill totaling 4,500,000 cu.yd. in place. Flat or rolled area near center of photograph has reached height of about 80 ft. above original stream bed. In background are rock quarry and grizzly plant for separating 6x9-in. pieces from quarry run.

San Gabriel Dam Rockfill

FROM DOWNSTREAM SIDE of dam rock fill is rising across river channel. At left of contractor's shop, below toe of dam, is main sump supplying water for sluicing rock.

25 CU. YD. is capacity of this remodeled truck, with ten rubber-tired wheels, being loaded with rock by 4-yd. electric shovel at point below spillway excavation.

CURRENT PROGRESS in placing a total of about 10,600,000 cu.yd. of rockfill and fine impervious material in six "zones" of San Gabriel dam No. 1, in Southern California, is pictured in the accompanying illustrations of the work being done under the direction of the Los Angeles County Flood Control District by the West Slope Construction Co. The big embankment across the bed of the San Gabriel River, which has been bypassed around the site through a 30-ft. diameter diversion tunnel, 1,850 ft. in length, will be about 375 ft. high above bed rock, 1,540 ft. long on its crest and 1,950 ft. wide from toe to toe at its base.

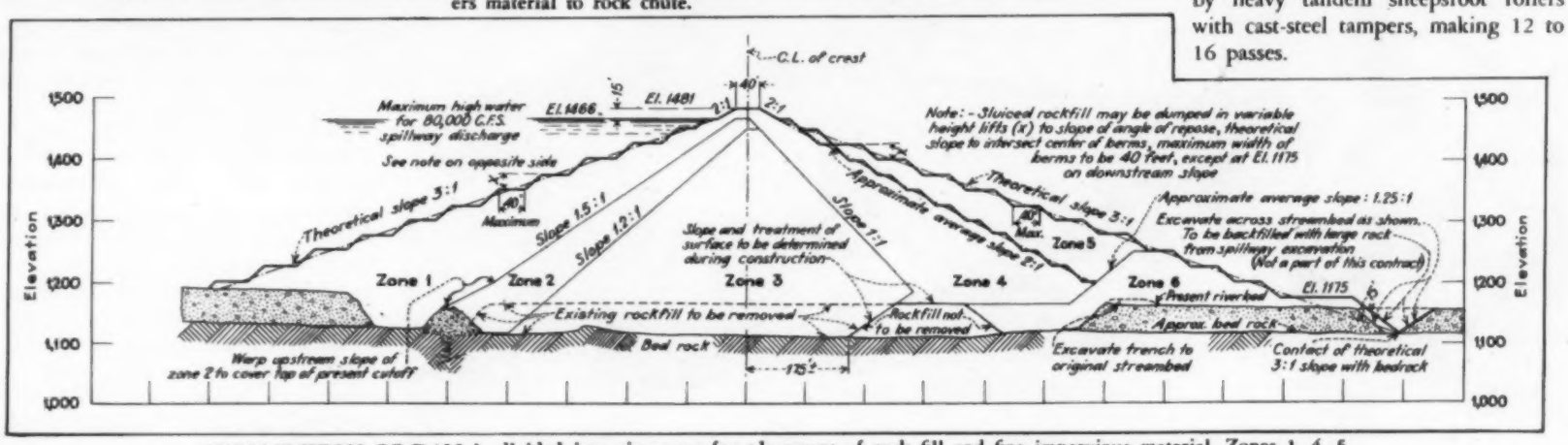
As indicated in the accompanying drawing, the slopes of the upstream and downstream faces of the dam are 1 on 3 and for the placement of ma-

HEAVY ABUTMENT EXCAVATION *(right)* will be required at end of cutoff wall, located at center of picture. View is toward right or west abutment.

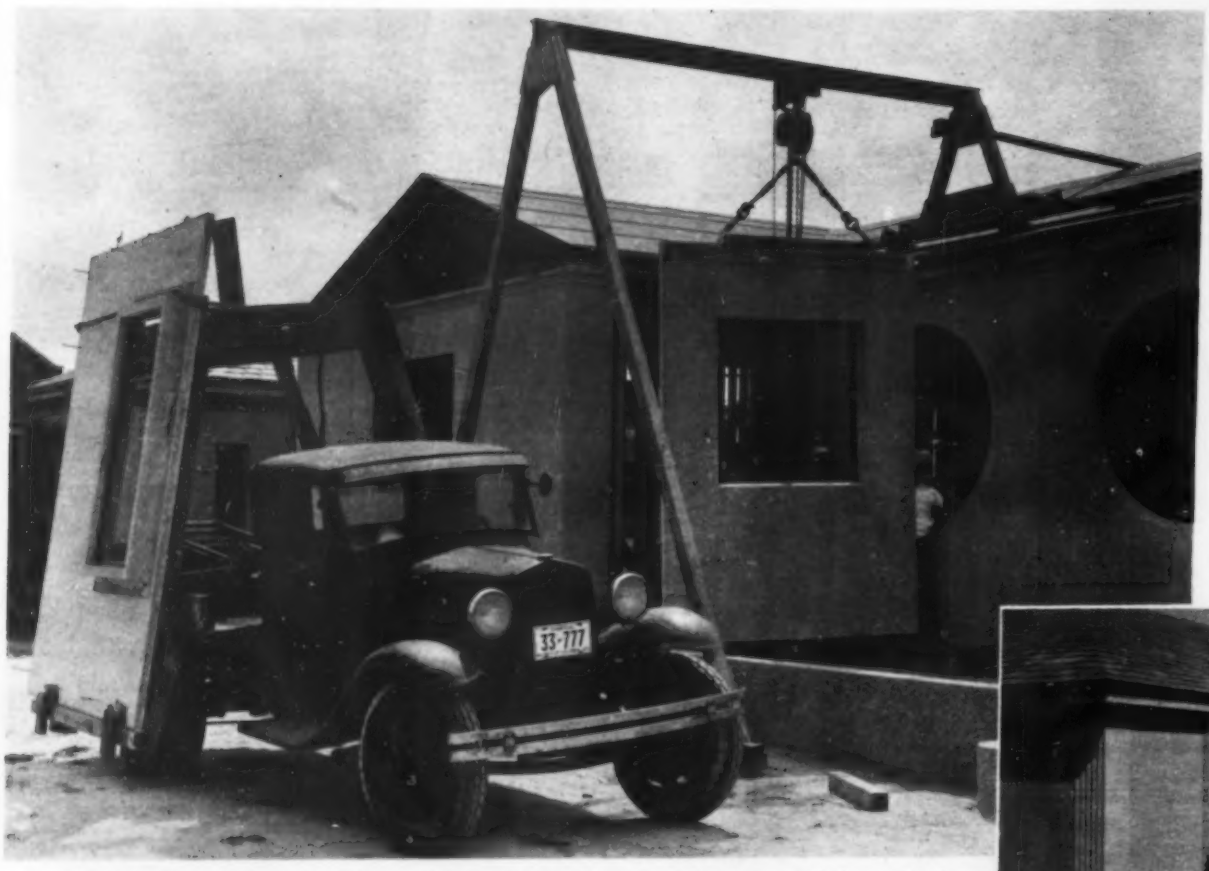
QUARRY AND GRIZZLY PLANT, with bins for fine material passing 6x9-in. grizzly (at left), delivers material to rock chute.

SPECIAL BODIES, holding 25 cu. yd., and two rear axles carrying dual wheels with big pneumatic tires, are features of new truck fleet handling daily output of 30,000 cu. yd. of quarried rock fill for dam.

terial the cross-section of the embankment is divided into six zones, as follows: Zones 1, 4, 5 and 6 receive dumped rock which is hosed or "sluiced" with high-pressure jets applying water at a rate approximately double the volume of rock placed. Zone 2 consists of a compacted, impervious blanket of fine material, which is protected from erosion by wave action and from drying out by the material in Zone 1. Zone 3, forming the main body of the dam is built up of quarried rock passing a 6 x 9-in. grizzly and compacted by heavy tandem sheepsfoot rollers with cast-steel tampers, making 12 to 16 passes.


C.L. of crest
Maximum high water for 80,000 C.F.S. spillway discharge
El. 1486
El. 1481
See note on opposite side
Theoretical slope 3:1
Maximum
Slope 1.5:1
Slope 1.2:1
Slope and treatment of surface to be determined during construction
Slope 1:1
Approximate average slope 2:1
Note: - Sluiced rockfill may be dumped in variable height lifts (x) to slope of angle of repose, theoretical slope to intersect center of berms, maximum width of berms to be 40 feet, except at El. 1175 on downstream slope
Theoretical slope 3:1
Max.
Approximate average slope: 1.25:1
Excavate across streambed as shown. To be backfilled with large rock from spillway excavation (Not a part of this contract)
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
El. 1175
Present riverbed
Existing rockfill to be removed
Rockfill not to be removed
Approx. bed rock
Bed rock
Warp upstream slope of zone 2 to cover top of present cutoff
175'
Excavate trench to original streambed
Contact of theoretical 3:1 slope with bedrock
Elevation
1500
1400
1300
1200
1100
1000

CROSS-SECTION OF DAM is divided into six zones for placement of rock fill and fine impervious material. Zones 1, 4, 5 and 6, dumped rock sluiced with water jets. Zone 2, compacted impervious blanket of fine material. Zone 3, compacted rock passing 6x9-in. grizzly.



PRECAST WALL PANEL delivered in upright position on light motor truck is set in place against studs of house frame by trolley chain hoist. Window frames are cast in place in concrete panels.

THIN PRECAST CONCRETE SLABS Form Walls of Small Houses

LONG EXPERIENCE in precasting mosaic concrete units for monumental buildings leads John J. Earley to adopt material to small house construction.

28 PREFABRICATED PANELS of exposed aggregate concrete compose walls of house containing three bedrooms, bath, kitchen, utility room, large living room and dining room. Architect utilizes freedom of design afforded by plastic material to incorporate round Japanese windows in front wall panels.

FIVE SMALL HOUSES completed in the District of Columbia by the Earley Process Corp., of Washington, demonstrate the feasibility, beauty and economy of using thin precast panels of concrete of the exposed-aggregate type for exterior walls. Story-height slabs 2 in. thick cast in molds in the corporation's shop across the Potomac River in Rosslyn, Va., are trucked to the building site and erected against the studs of a wood or steel frame already in place. A permanent wall facing of impervious concrete can be applied to a house in this way at about the same cost as brick veneer. Wall slabs are set on concrete foundation walls in a shiplap joint pitched to drain and are anchored to light concrete columns at each vertical joint by a special device which allows movement.

HOUSE EXTERIOR incorporating precast units in solid color or polychrome patterns for wall panels, pilasters, cornice, doorway and flagstones reveals possibilities of exposed aggregate concrete in achieving colorful variety in residence construction.

Slab Manufacture — Strength, durability and beauty are built into the panels by a manufacturing process which calls for skilled workmanship and accurate control of materials. Graded aggregates of crushed quartz, ceramics or vitreous enamels, depending upon the color wanted, are mixed with a white cement and water paste and placed in a flat shallow mold about 9x10 ft. in area and 2 in. deep. If the design of the face of the panel calls for a color pattern the outlines of the pattern are marked in shallow ridges, about ⅛ in. high, on the mold, and the various colors of concrete are placed inside the ridges. Over this colored layer, the craftsmen place welded wire mesh reinforcement and build up the panel to 2-in. depth with concrete containing quartz coarse aggregate and coarse sand. The colored concretes contain no pigment, the colors in a panel being produced entirely by the aggregates incorporated in the concrete.

Sufficient water is used in the mixture to permit the plastic concrete to flow into all corners of the mold. After concrete has been placed to a 2-in. depth, free water is removed by blotting with an absorptive material ap-

plied to the back of the panel. Initial removal of excess water by this method keys the aggregate particles securely in the mass and prevents segregation when a vibrator is applied to the mold to bring additional water to the surface for a second blotting, which removes practically the last of the surplus water from the concrete.

After hardening for 12 hr. the panel is turned on edge and removed from the mold to permit the surface mortar to be scraped off with wire brushes, exposing the aggregate. The face of the panel then is washed with weak muriatic acid to reveal the full brilliance of the coloring. Following the washing, panels are cured in a controlled humidity chamber for 14 days; at the end of this time they have a crushing strength of about 5,000 lb. per square inch. When erected at the site, with sealed expansion joints between the panels, the slabs form a waterproof wall of unfading color which can be washed with a hose or scrubbed with a brush, if required.

Expansion Joints — Dowel bars protrude from the rear of the slab near the vertical edges. These bars are hooked to vertical reinforcing rods in a light concrete column which is cast behind each expansion joint between adjacent slabs. A piece of rubber tube

SKILLED craftsmen cast wall panel in horizontal mold. After placing layer of colored aggregate concrete in bottom of mold, workmen set welded wire reinforcement and build up panel to 2-in. thickness with quartz aggregate concrete.

SECTION of wall shows window frame cast in place, rock wool insulation and treatment at expansion joint. Note foundation wall pitched to drain.

about 1½ in. long is slipped on each dowel against the back of the slab to provide a cushion for movement of the dowel after the column has been cast. A lead foil seal is placed across the back of the open joint between the slabs to protect the concrete column from moisture and prevent a bond at this point between the column and the two slabs. Joints of this design have functioned successfully through all extremes of Washington weather and have passed through the severe winter of 1935-36 without damage to themselves or to the concrete slabs.

Background of Process—Experience gained by John J. Earley, architectural sculptor, and his studio in casting thin concrete panels of intricate design and elaborate details for such monumental structures as the Bahai Temple (described in Construction Methods, July, 1933, pp. 34-36) and the mosaic concrete panels for the ceilings of the open areaways in the new Department of Justice Building, in Washington, D.C., led Mr. Earley and his associates to the logical development of applying the same type of structural material to exterior walls of residences. During the 15 years in which the studio had been perfecting the art of applying mosaic concrete of the exposed-aggregate type to architectural purposes, Mr. Earley and his artisans had so refined and simplified the process of casting thin slabs that it could be turned with assured success and economy to the production of wall panels for houses.

Up to the present the organization has made no attempt to adapt this structural material to any other standard features of house construction than exterior walls, desiring first of all to prove its worth for this purpose and to leave any further application of precast slabs (as in roofs, floors, or interior wall panels) to possible future development by themselves or by others in the house-building field. The manufacturing process can be carried out only by skilled craftsmen in properly equipped shops, but it opens extensive opportunities for mass production with attendant economies.

Erection of Wall Slabs—An accompanying photograph illustrates the ease of handling and erecting wall slabs in a house. A simple carrier of A-frame construction on a light motor truck is used to transport the slabs from the shop to the site. Ordinarily the truck is able to drive under a trolley hoist traveling on a steel beam supported at one end by a tall A-frame resting on the ground and at the other end by a short A-frame resting on the roof rafters of the house. The chain hoist picks the slab off the truck and places it in final position against the studs of the house frame.

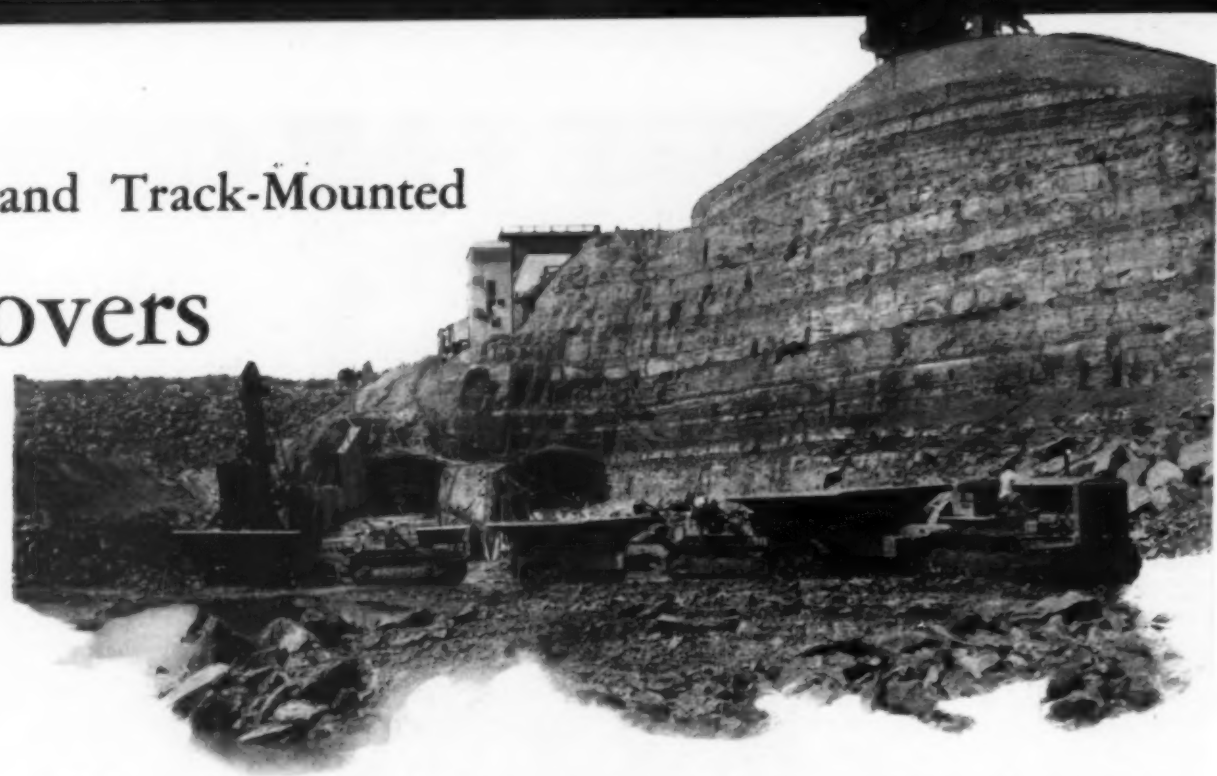
ACID WASHING removes cement film from surface of wall panel, exposing vitreous enamels and quartz used in outer layer of slab. Panels are kept in humidity chamber for 14 days following removal from molds.

Insulation — For comfort in hot weather and heat-saving in winter, houses so far constructed by the Earley Process Corp. have been insulated with bats of rock wool placed between the studs in the exterior walls. Utilization of standard stud spacing for exterior walls faced with precast slabs allows economical application of standard-size rock wool bats.

Pneumatic-Tired and Track-Mounted

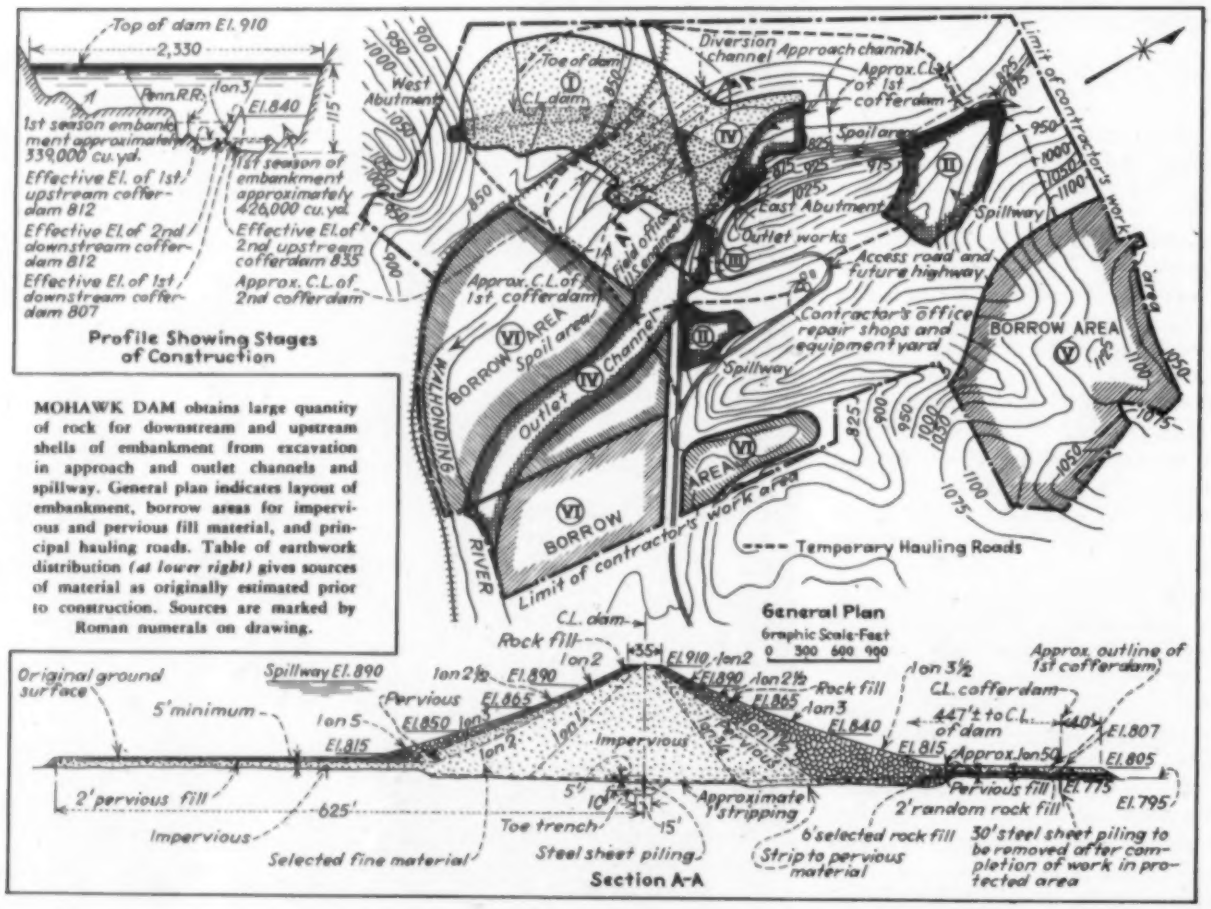
Earth Movers

Haul Materials for Rolled Earthfill Dams



At 13 Muskingum Valley Reservoirs···· *Part 2*

TRACK WAGONS drawn by diesel tractors supplement large fleet of pneumatic-tired equipment at Mohawk, hauling rough rock excavation from outlet and approach channels to point of placement in outer shell of embankment at left. Mixing plant containing two 1-yd. mixers is placed on slope above two 20-ft. horseshoe-section concrete-lined outlet tunnels 360 ft. long.



MOHAWK DAM obtains large quantity of rock for downstream and upstream shells of embankment from excavation in approach and outlet channels and spillway. General plan indicates layout of embankment, borrow areas for impervious and pervious fill material, and principal hauling roads. Table of earthwork distribution *(at lower right)* gives sources of material as originally estimated prior to construction. Sources are marked by Roman numerals on drawing.

charge of the work, one of the best quick tests for an embankment is its behavior under the load of construction equipment. There should be a visible wave as the equipment passes over it, followed by an immediate rebound. This wave shows that the material has the water content to give it a plastic condition but not an excess of water. It is possible that a material with no wave may have just the right amount of water, but the chances are that it is underwatered. If there is much wave, there is too much water, and if the surface has a tendency to show a large number of small cracks, the material below has too much water.

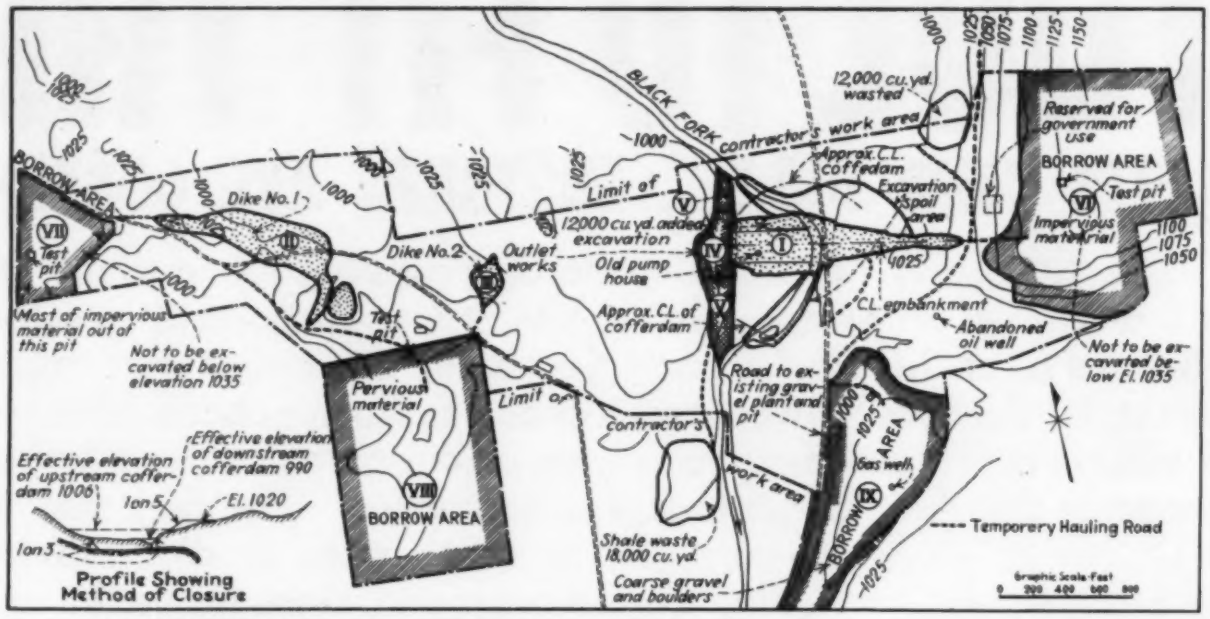
Typical Job Layouts — Although design of rolled earth embankments and quantities of materials involved vary widely among the thirteen sites, general conditions governing the construction operations are relatively uniform at all locations. Maximum height of embankment ranges from a low of

HAULING EQUIPMENT plays an important role in compacting fill material in the thirteen rolled earth dams of the Muskingum Watershed Conservancy District. To give the entire embankment the benefit of this consolidation, equipment operators are kept from following a common track. The top layer is not rolled to its ultimate compaction, as complete compaction would interfere with its making good bond with the succeeding layer. Furthermore, it is desired that the old layer take up a part of the water that is sprinkled on it just ahead of the new layer, in order that the top 2 or 3 in. of the old layer and the bottom 2 or 3 in. of the new layer shall be moist.

Shale requires a great deal more water than earth, particularly if the shale is dry when excavated. In some cases water to an amount of as much as 10 per cent of the dry weight of the shale must be added. No compaction is obtained by rolling sticky material, but occasional rolling on a layer that is too wet helps to dry it to such a condition that it can be rolled to advantage. According to engineers in

Approximate Earthwork Distribution — Mohawk Dam

Description	I Dam And Blanket	II Spillway	III Outlet Works	IV Approach & Outlet Channels	V Borrow	VI Pits	Total
Stripping	87,000						87,000
Common excav.	255,200	306,000	54,800	684,000			1,300,000
Borrow excav.					250,000	250,000	500,000
Rock excavation	1,400	299,600	135,000	39,000			475,000
Tunnel excav.			16,000				16,000
Backfill uncompacted			13,000				13,000
Backfill compacted			700				700
Impervious fill	1,222,000						1,222,000
Pervious fill	426,000			34,000			460,000
Rock fill	512,000		4,200				516,200
Riprap	20,000			45,000			65,000



CHARLES MILL DAM consists of main embankment, outlet works and two dikes. Material for impervious cores and pervious shells of three structures (built to crest elevation 1035) is taken from areas indicated on general construction plan *(above)*. Table of approximate earthwork distribution *(at right)* lists original estimates of quantities to be obtained from excavation at various sites, marked with corresponding Roman numerals on drawing.

Approximate Earthwork Distribution — Charles Mill Dam

Description	I Dam	II Dike No. 1	III Dike No. 2	IV Outlet Works	V Approach & Outlet Channel	VI Borrow Pits	VII Borrow Pits	VIII Borrow Pits	IX Borrow Pits	Total
Stripping	4,000	6,000	1,000							11,000
Common excav.	81,000	18,500	5,200	25,100	32,200					162,000
Borrow excav.						167,000	42,000	95,000	56,000	360,000
Rock excavation				13,000	14,000					27,000
Rock excav. in trenches	210			340						550
Backfill uncompacted				400						400
Backfill compacted	1,800									1,800
Impervious fill in dam	170,000									170,000
Pervious fill in dam	95,000									95,000
Earth fill in dikes		105,000	20,000							125,000
Rock fill in trenches	11,500	2,900	600							15,000

46 ft. at Mohicanville to 130 ft. at Pleasant Hill. Volume of earth embankment likewise ranges widely, as has been noted (in last month's installment). Embankment lengths vary from a maximum of 6,300 ft. at Bolivar to a minimum of 775 ft. at Pleasant Hill.

Except at a few locations where an abundance of rock calls for a special operation of some magnitude, the main problem facing the contractors at all sites consists of removing clay and shale from structural excavations or borrow pits and transporting the materials an average distance of 1,500 to 2,000 ft. into the embankment. In a few cases hauls of less than 1,000 ft. or of as much as 2 mi. in length are called for to move certain classes of material into the embankment, but on most of the jobs a range of 1,200 to 2,500 ft. takes care of all the hauling.

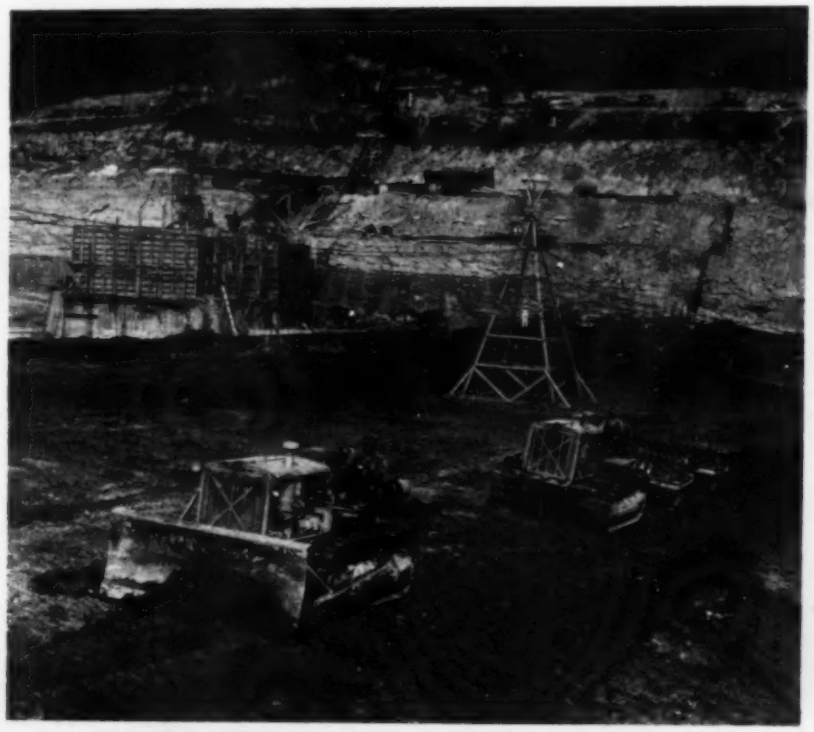
Geheral earthwork plans accompanying these notes indicate typical job layouts at four sites: Charles Mill, Leesville (in last month's installment) Mohawk, and Tappan. Two of these layouts, Leesville and Tappan, also indicate the contractors' procedure in attacking the jobs. Because of the relative uniformity of excavating and hauling conditions at all sites, the contractors' methods of earth moving followed a common pattern.

To obtain a proper mixture of excavated materials for placement in the rolled embankment, both engineers and contractors preferred to have the digging done with power shovels. Probably 75 to 80 per cent of the excavation at the 13 earth dams is dug with shovels. These units range from 1 to 2½ yd. in dipper capacity, with most of them falling in the 1¼- to 1¾-yd. range. In the opinion of engineers in the central office at Zanesville, about 50 per cent of the shovels are operated by diesel engines, about 37½ per cent by gasoline and the remaining 12½ per cent by steam.

Where borrow pits consist of uniform material which requires no mixing, contractors use power-operated elevating graders to advantage. Draglines of 1- to 2-yd. capacity are used to a limited extent in borrow pits, and practically all cutoff trenches and rock toe trenches are excavated by these machines.

At a few jobs tractor-drawn 12-yd. wheel scrapers mounted on pneumatic tires both excavate material and place it in the embankment. These scrapers spread their loads in dumping on the embankment, but bulldozers follow them to assure thorough distribution in a 6-in. uncompacted layer. All material dumped in the embankment is bulldozed before being compacted with sheepsfoot rollers.

To move material from the excavation to the embankment, most of the contractors have shown a preference for pneumatic-tired 9-yd. truck and semi-trailer units. For hauling rock and for the initial resumption of hauling to embankment after a rain, the majority of the contractors continue to rely upon tractor-drawn track wagons. At a number of locations, large fleets of pneumatic-tired trucks are hauling earth and rock. In a few instances pneumatic-tired carts of 30-yd. capacity, mounted on 16 wheels, are moving fill material into the embankment. Experience records at a few typical jobs give some idea of the relative earth-moving abil-



BULLDOZER SPREADS embankment fill in 6-in. layer at Wills Creek prior to compacting by sheepsfoot tampers hooked in tandem behind diesel tractor. This procedure is typical of embankment construction on all thirteen earth dams in Muskingum district.

SELF - POWERED ELEVATING GRADER of type used on several projects strips dam area at Tappan.

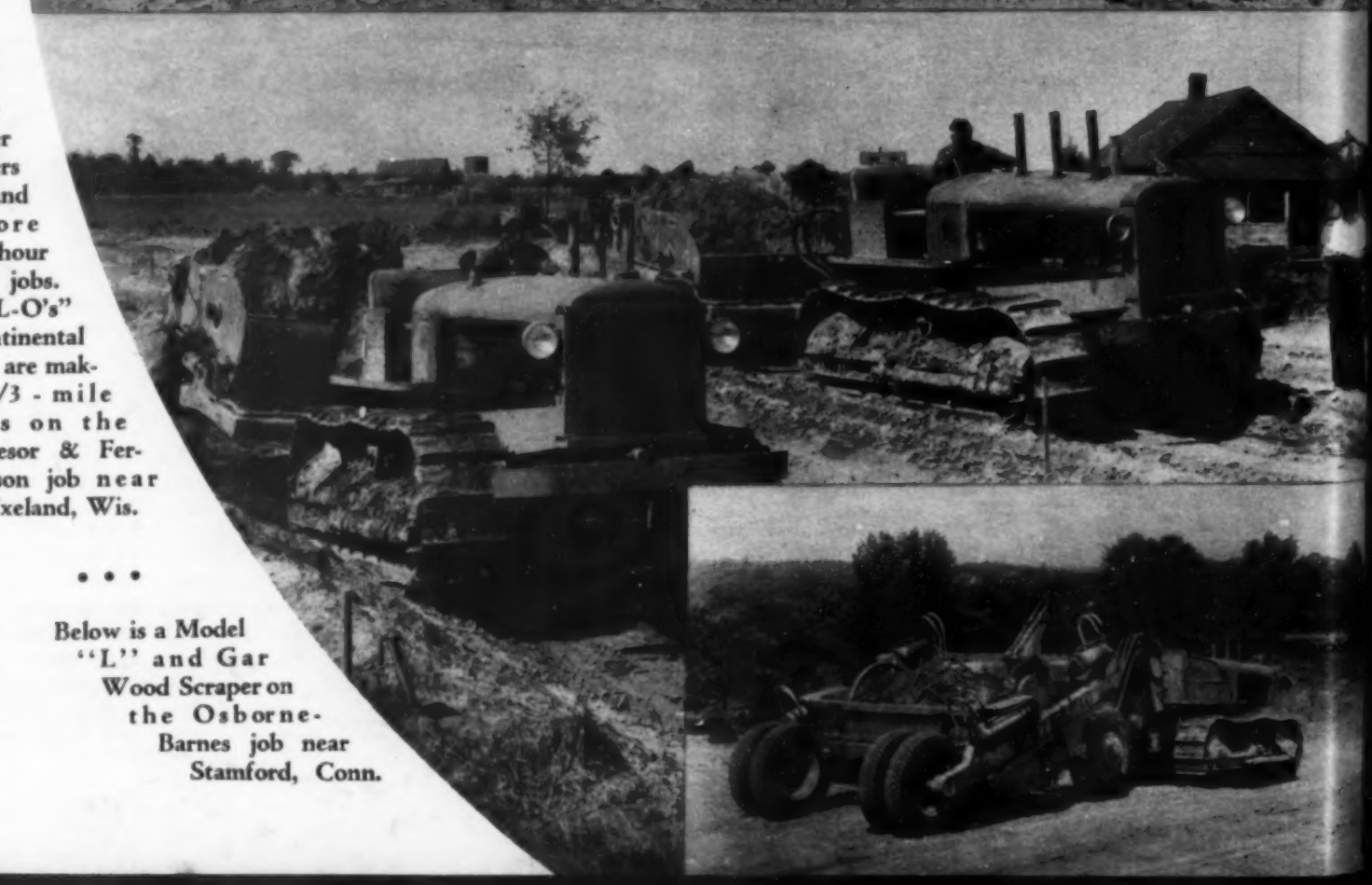
THE TOOL TO FIT THE

WHICH TYPE FITS YOUR JOB?... MISTAKES ARE COSTLY!

The "best way" to handle one dirt moving job may be far from best on another—that is why it is so important to select "the tool to fit the job." Before you make a decision that might mean the difference between success and failure—check with the man who is best suited to give you an unbiased recommendation. This man is the Allis-Chalmers representative. The fact that he has a COMPLETE line—adapted to ALL types of dirt moving work—enables him to make his recommendation honestly and without prejudice. Your A-C representative is more than a salesman—he is schooled to help you select the proper outfit for the job.

SHORT HAULS

When it's an elevating grader job, here's the winning combination—a Model "L" or "L-O" on the grader and "K's" or "K-O's" on the wagons. This is the J. A. Carlson job near Malvern, Ia.



MEDIUM HAULS

The fast-stepping easy-to-maneuver Allis - Chalmers tractor digs and carries more loads per hour on scraper jobs. These "L-O's" and Continental Scrapers are making 1/3 - mile hauls on the Genesor & Ferguson job near Exeland, Wis.

• • •

Below is a Model "L" and Gar Wood Scraper on the Osborne-Barnes job near Stamford, Conn.

JOB

BULLDOZING

Operators call the "K" and "K-O" the sweetest pair of bulldozing tractors ever to level a grade. This "WK" is on the Connell & Laub job near Marquard Mills, O.

BLADE WORK

Topped by the big Power Controlled No. 14 Grader with the exclusive Leaning Frame feature, the A-C grader line is designed "to fit the job." This all A-C outfit — Model "L-O," No. 12 Grader and No. 54 Speed Patrol — are owned by Chaves County, N. M.

LONG HAULS

Where hauls are long, and high traveling speed important, the Speed Ace hauling unit is "the tool for the job." George W. Condon has 11 Speed Aces on this job at the Casper-Alcova Dam in Wyoming.

MAINTENANCE

Whether the work is straight maintenance, oil mix, ditch work, or what not— Allis-Chalmers has a patrol to fit. Single or tandem drive. Two sizes, Gasoline or Diesel fuel oil. This is the Esty Paving Co. job, Cameron, S. C.

ALLIS-CHALMERS
TRACTOR DIVISION—MILWAUKEE, U. S. A.

Controlled Ignition OIL TRACTORS

ity of the various types of equipment.

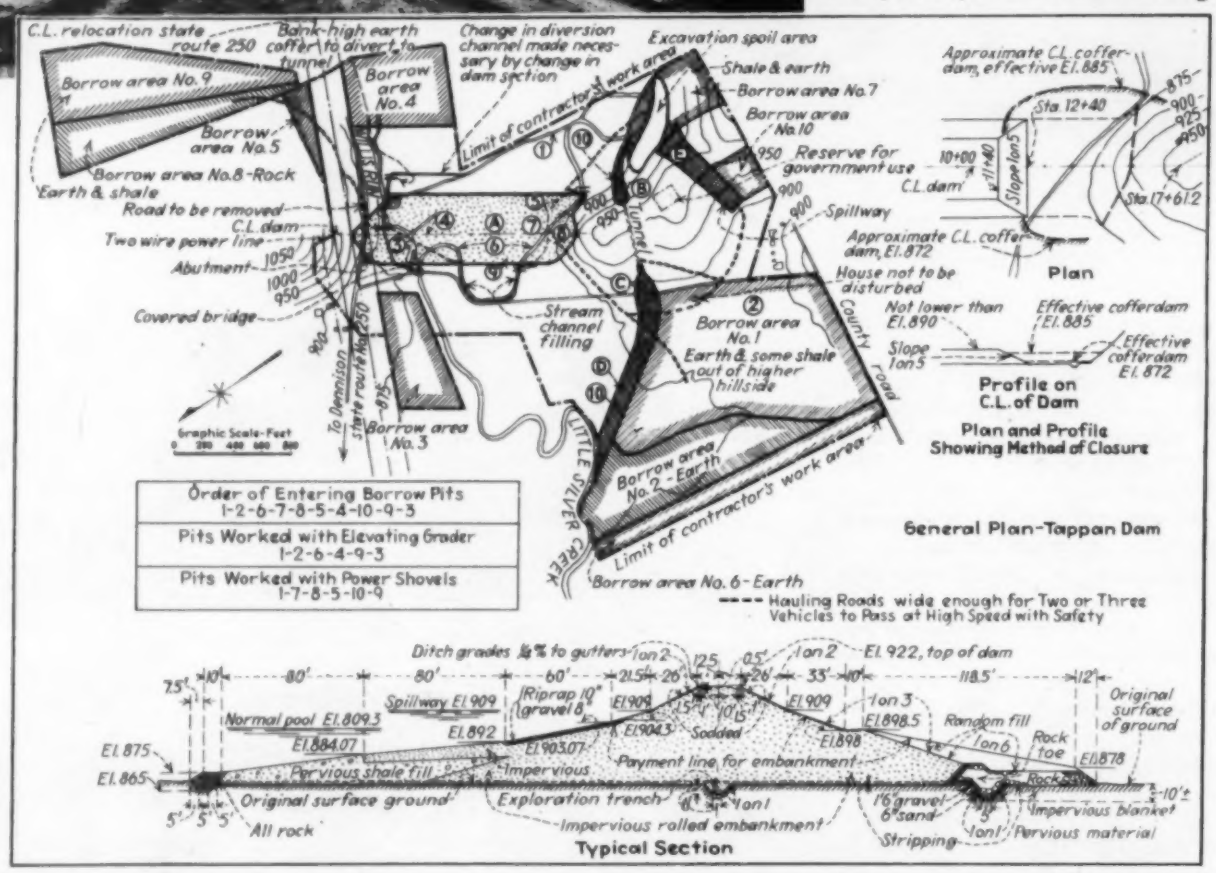
Charles Mill — For conditions on the Ryan & Myers contract at Charles Mill dam, a combination of tractor-drawn track wagons and pneumatic-tired truck and semi-trailer units proved almost ideal. After heavy rains, the tractor-drawn wagons often were ready and able to move earth into the embankment before the engineers could permit them to travel on the fill. The tractors and track wagons were capable of carrying loads over almost any kind of road. When the roads were in good condition, the pneumatic-tired truck and trailer units were able to move earth twice as fast as the tractors.

Two 1¼-yd. shovels, one diesel and one gasoline, dug fill material from structural excavations and borrow pits. To move the material into the embankment, the contractors used four track-wagon trains and six Euclid Trac-Truks. Each of the track-wagon trains consisted of a Caterpillar 75-hp. diesel tractor drawing two Euclid crawler-mounted wagons, one of 10-yd. and the other of 7-yd. capacity. All of the Trac-Truks originally were equipped with gasoline engines. During the course of the job, diesel power was substituted in some units.

With the two shovels and all of the hauling units in operation, this outfit moved as much as 6,000 cu.yd. into the main embankment and dikes in 15 hr. On their best days, 20 hr. in length, the equipment moved 8,000 and 9,000 cu.yd. In one period of 12 consecutive days, the hauling units took away from the two shovels 72,900 cu. yd. of material

Mohicanville — Winston Bros Co., contractor, last year equipped this job with a Marion 1¾-yd. diesel shovel and three LeTourneau 30-yd. pneumatic-tired buggies, each drawn by a 75-hp. Caterpillar diesel tractor. With only two of the buggies operating through a 20-hr. day of four shifts, the contractor was able to move as much as 4,240 cu.yd. For a long period with only two buggies working, the outfit was able to maintain an average of 1,500 to 2,000 yd. for each 20-hr. day of four shifts. Each buggy carried a load of 26 to 28 cu.yd. of excavated material; loaded, the unit weighed about 50 tons.

Leesville — At Leesville the Culbertson Construction Co., contractor, equipped the job with one 1½-yd. diesel dragline, one 1½-yd. steam shovel, one 1¼-yd. gasoline shovel, one power-operated 42-in. elevating



OPERATIONS AT TAPPAN DAM are outlined by general plan *(above)* and table of quantities as originally estimated *(below)*, with circled letters on two charts serving as cross-reference to identical areas. Circled numbers on drawing indicate contractor's sequence of operations in attacking project:

(1) Excavate diversion channel; (2) strip portion of borrow area No. 1 with elevating grader; (3) strip dam area with elevating grader; (4) dig exploration trench, tracing and removing all farm drain tile encountered and backfilling ditches; (5) construct cofferdams upstream and downstream; (6) fill stream channels and dig toe trench with 1¼-yd. dragline; (7) place rolled earthfill embankment, hauling from borrow areas No. 1 and No. 2; (8) start keywall excavation in south abutment; (9) place sand and gravel fill and rock filter in toe trench; (10) excavate intake, stilling basin and channels and drive tunnel from both portals while other operations are in progress. As soon as concrete has been placed in tunnel, stilling basin and three lower lifts of intake tower, divert stream.

Approximate Earthwork Distribution — Tappan Dam

Description	A Dam	B Intake & Inlet Channel	C Tunnel & Stilling Basin	D Outlet Channels	E Spillway	Roadway	Stream Channel Below Dam	Borrow Pit	Total
Stripping	16,000								16,000
Common excav.	31,420	4,000	7,000	20,000	30,000	9,000			101,420
Borrow excav.				28,000				372,000	400,000
Backfilling		350	1,350						1,700
Rock excav.	110	2,600	3,600		55,000	1,000			62,310
Tunnel excav.			1,900						1,900
Earth fill	385,000								385,000
Channel fill							6,600		6,600

pay dirt. The 8-yd. wagon operates in place of either of the two larger wagons if one of them happens to be down for repairs or is hooked as a trailer behind one of the wagons, both of which are drawn by Caterpillar 75-hp. diesel tractors. In addition to his own hauling equipment, the contractor rented up to eight trucks carrying 4 yd. of pay load each.

Operating this combination of equipment, the contractor averaged about 128 cu.yd. of compacted fill in the embankment for each hour that material could be placed there. In a period of 16 calendar days in which the equipment was able to work on 12 days, the total operating hours amounted to 139. In this time the equipment placed 17,870 cu.yd. of pay dirt in the embankment, an average of 128 cu.yd. per hour. For another 9-day period during which the equipment operated for 89 hr. the contractor placed an average of 128.5 cu.yd. per hour.

Tappan — Material for Tappan dam was excavated by three 1½-yd. shovels (two gasoline and one diesel), a 1¼-yd. gasoline shovel and a 48-in. Caterpillar gasoline-driven elevating grader equipped with a 26-ft. carrier and usually operated with a 30-in. disk. One of the shovels served part time as a dragline. Material was hauled by eight 8-yd. Euclid Trac-Truks, five 3½-ton dump trucks and three Euclid 10-yd. side-dump track wagons pulled by diesel tractors. At times this hauling equipment was supplemented by a fleet of 14 or 15 rented trucks.

A construction schedule was set up by the contractor calling for 80,000 cu.yd. per month in the embankment. This progress required 4,000 yd. a day out of the borrow pits. A summer of abnormally heavy rainfall prevented the contractor from maintaining the projected construction schedule, and the earth-moving plant was stepped up to get greater production in good weather. On its best day, the earth moving outfit put 9,000 cu.yd. of pay dirt in the embankment. On an average day, the equipment produced about 5,500 cu.yd. from the borrow pit in 15 hr. For an average day, the excavating equipment consisted of the elevating grader, one shovel, and one dragline. No rented trucks were used on such days. The average haul was about 3,000 ft.

According to D. T. Hogue, superintendent, the elevating grader loaded an 8-yd. trailer in 35 sec., an average of about 1 yd. of pay dirt every 5 sec. On its best day the grader put out 4,200 cu.yd. in 15 hr. It averaged about 250 yd. an hour on an average day. The material handled by the elevating grader was a heavy clayey silt containing practically no sand. It was observed on this job that on a haul of 1,500 ft. the pneumatic-tired semi-trailer unit hauled about 40 cu.yd. an hour in comparison with about 20 cu. yd. an hour by the tractor-drawn track wagons. The pneumatic-tired units could come out of the borrow pits any time that the tractors and track wagons were able to make the grade. According to Mr. Hogue, the pneumatic-tired trailers often rode quaky ground when the track wagons could not.

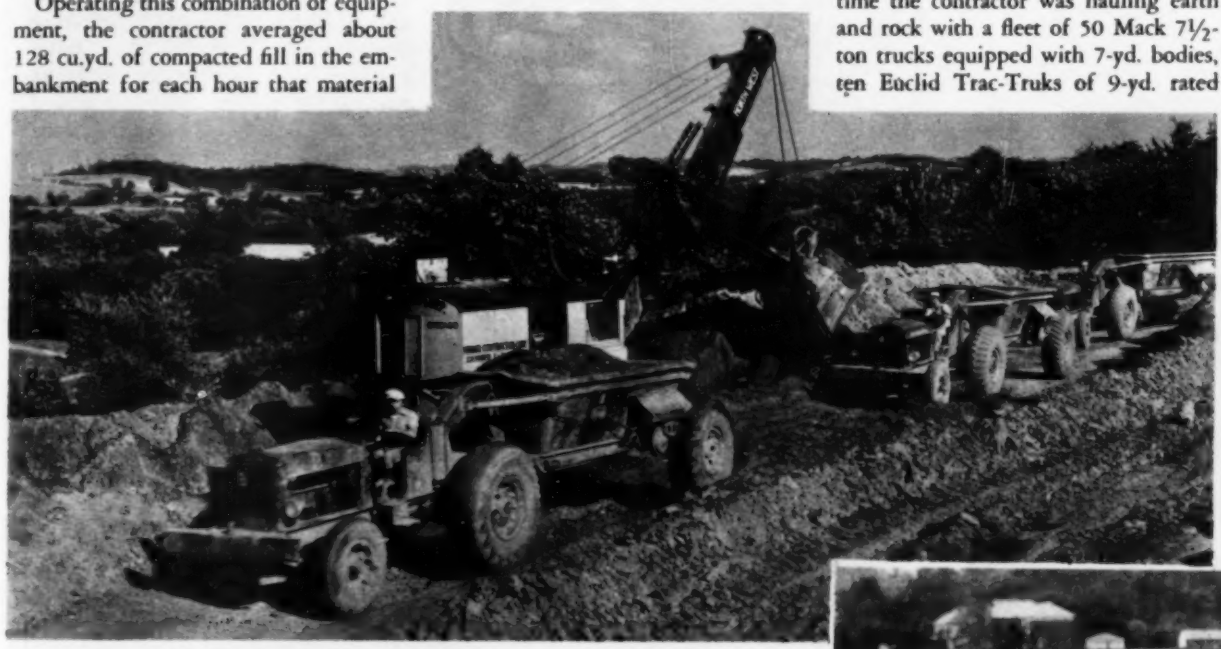
Mohawk — Last year at Mohawk dam George M. Brewster & Son, Inc., contractor, operated nine Thew-Lorain 1¼-yd. diesel shovels, in addition to a Koehring 1¾-yd. diesel and a Bucyrus-Erie 1⅜-yd. gasoline machine. At that time the contractor was hauling earth and rock with a fleet of 50 Mack 7½-ton trucks equipped with 7-yd. bodies, ten Euclid Trac-Truks of 9-yd. rated capacity, and five Linn tractor-trucks which had been equipped with aluminum-alloy scoop-shaped bodies of 12-yd. capacity in place of the original 8-yd. steel bodies, which had been battered and broken by hard service.

This array of equipment last year placed as much as 20,000 cu.yd. in the embankment in 14 hr., consisting of pervious, impervious, and rock. Euclid bottom-dump Trac-Truks were found efficient for hauling impervious fill and traveling in soft ground, but they could not handle the rough sandstone and shale which constituted about 50 per cent of the material at this project.

Continuous rains last year wrecked the construction schedule at Mohawk. Trucks especially were delayed by the heavy going. To overcome this condition, the contractor used Warco traction treads, consisting of a series of flat plates, or links, wide enough to cover the two tires on dual wheels. These traction treads enabled the trucks to operate in soft ground and to climb wet grades up to 7 per cent, but they cut down the carrying capacity by about 1½ tons.

During the 1936 construction season, what may be called a typical week at Mohawk was that ending June 4, in which the contractor excavated 26,600 cu.yd. of common material from the approach channel, outlet channel and intake and removed 8,600 cu. yd. of rock from the stilling basin, outlet channel and intake. In the dam embankment the contractor placed 17,000 cu.yd. of impervious, 6,000 cu.yd. of pervious, an 3,450 cu.yd. of rock. During the following week the excavators removed 35,000 yd. of common and 17,550 yd. of rock. When working in common excavation and borrow pits exclusively, the construction force excavated as much as 51,360 cu.yd. in the week ending July 21. During this week the contractor placed 35,350 yd. of pervious and 8,340 yd. of impervious, in addition to 845 yd. of compacted structural backfill. For this year's work the fleet of Euclid Trac-Truks was increased to 24 units, each carrying a 10-yd. load.

Administration — Construction work on the Muskingum Watershed Conservancy District project is carried out under the direction of the Corps of Engineers, U. S. Army, with Lt.-Col. J. D. Arthur, Jr., district engineer, in charge.



PNEUMATIC-TIRED SEMI-TRAILERS haul pervious and impervious material at Bolivar and many other sites. At Bolivar twenty 8-yd. semi-trailers and six diesel-fuel tractors drawing one or two track wagons of 6- to 12-yd. capacity place 672,000 yd. in embankment during 11-week period. Average haul is about 3,000 ft.

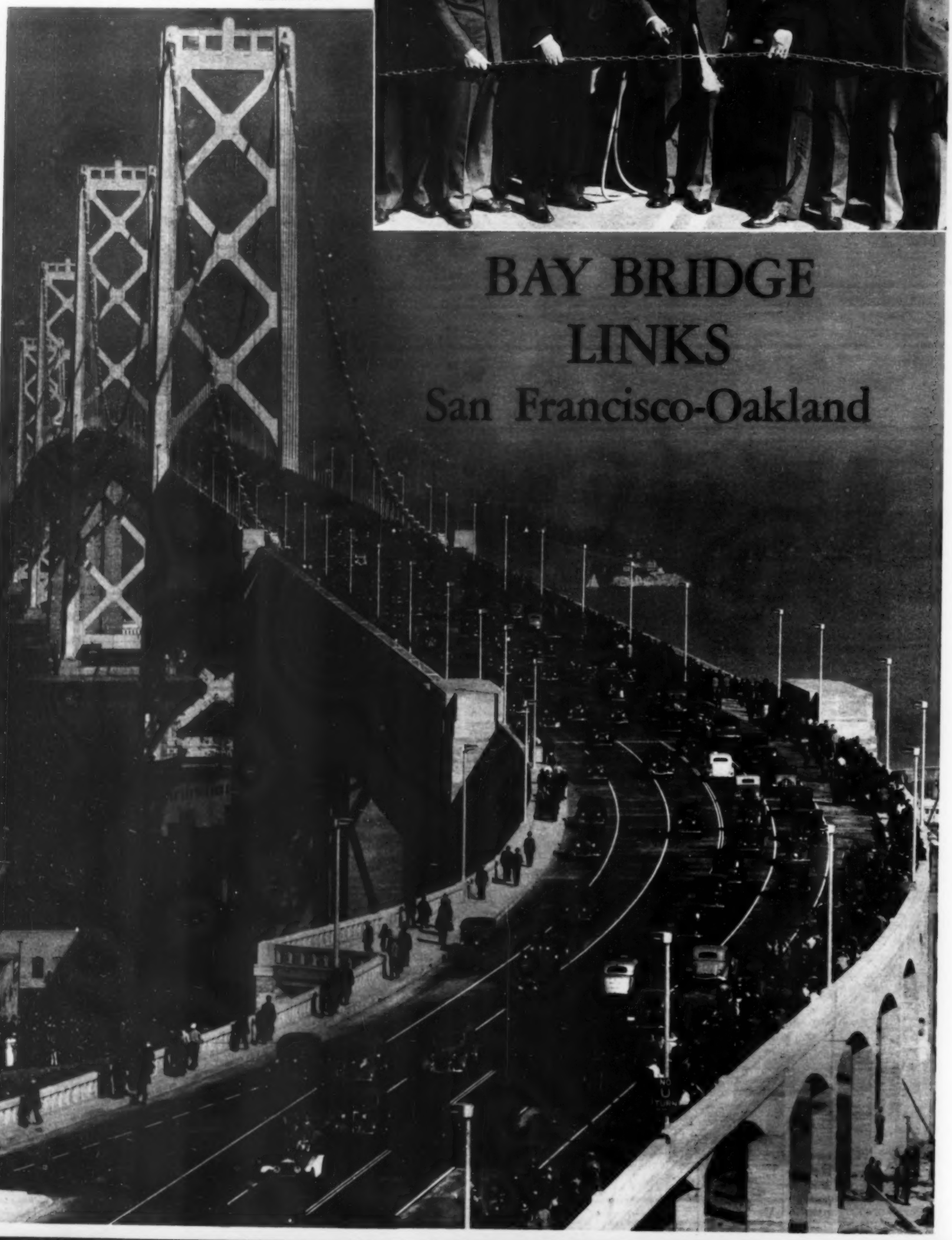
12-YD. CARRYALL SCRAPER at Beach City reservoir averages 1,200 to 1,780 cu.yd. per 15-hr. day in stripping 8-in. topsoil from meadow at dike location.

7-YD. DUMP TRUCKS haul excavated material from Mohawk spillway to spoil area, where earth and rock are spread by tractor-bulldozer.

BAY BRIDGE LINKS San Francisco-Oakland

FIRST TRAFFIC *(below)* crosses 8½-mi. San Francisco-Oakland Bay bridge Nov. 12 after Governor Frank F. Merriam *(right)* severs chain across roadway with oxyacetylene torch. In front row at opening ceremony are: (left to right) Mayor Angelo Rossi, of San Francisco, chief engineer Charles H. Purcell, former President Herbert Hoover, Governor Merriam, Charles Henderson, chairman, Reconstruction Finance Corp., and Senator William G. McAdoo, of California. Structure costing $78,000,000 and including two cable suspension bridges with 2,310-ft. main spans in addition to 1,400-ft. cantilever span is placed in service 40 months after work was started.

Wide World Photos



JOB ODDITIES

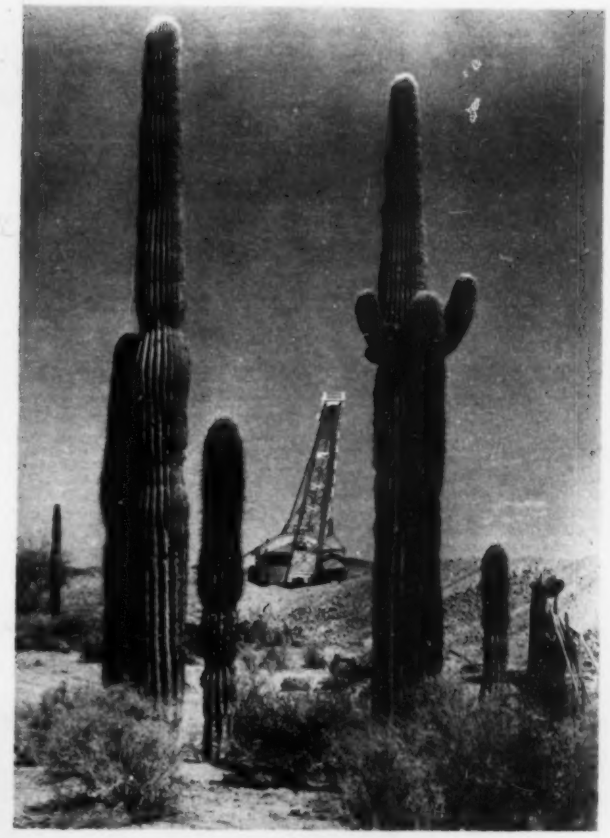
A MONTHLY PAGE OF

Unusual Features of Construction

THAR SHE BLOWS!

Gate valve operating test releases water under high pressure from 80-in. steel pipe, aluminum painted and nearly 4½ mi. long, forming Malheur River siphon of main canal on Reclamation Bureau's Owyhee project in Oregon.

Photo, U.S. Bureau of Reclamation



DESERT SENTINELS

in form of giant cactus plants, stand guard over dragline machine as it digs main canal for U.S. Bureau of Reclamation's Gila project in Southwestern Arizona. Gila project taps Colorado River where its flow is regulated near Yuma, below Boulder dam.

NATURE'S KNEE BRACES

(Left) Carefully adzed sections of tree trunks and boles support wave break on old timber crib wharf at isolated point on New Brunswick coast of Canada. —*Photo,* © Robert F. Legget, *Kingston, Canada.*

HOUSE DIVIDED AGAINST ITSELF

Structure on line of grade crossing project at Newburyport, Massachusetts, was owned by two men, only one of whom was satisfied with price offered for building. He sold his half, which was razed, leaving other half standing.

LEAF RAKING MECHANIZED

Littered streets in Flatbush section of Brooklyn, N. Y., are cleared by drafting into service belt conveyor loader and trucks intended primarily for snow removal.

World Photo

Getting Down to

DETAILS

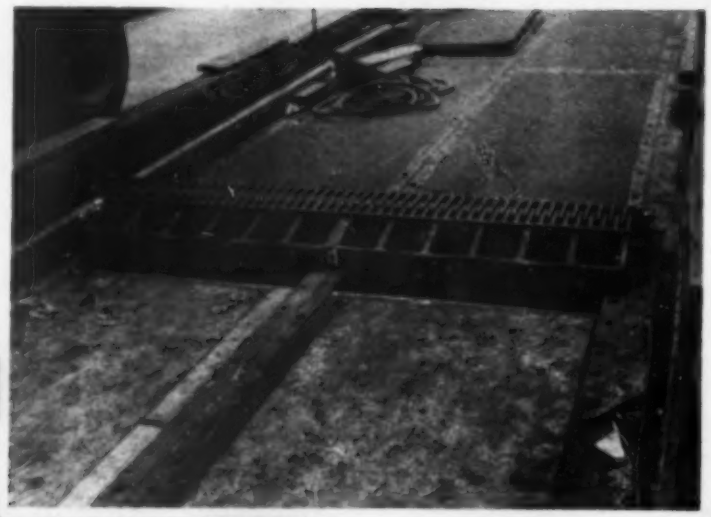
Close-Up Shots of Job Methods and Equipment

PLACING PRECAST CONCRETE PIPE

on a section of the Colorado River aqueduct is done by Lima crawler crane with 50-ft. boom handling 27-ton units at 29-ft. radius. Work by United Concrete Pipe Corp., of Los Angeles, calls for machine that is capable of handling loads accurately as metal rings in pipe ends have clearance of only 1/16 in. in making joint.

INCLINED SURFACE OF CURB

along steel member dividing roadways on Triborough bridge, New York City, is designed to minimize accidents to vehicles, as compared with curb having vertical face.

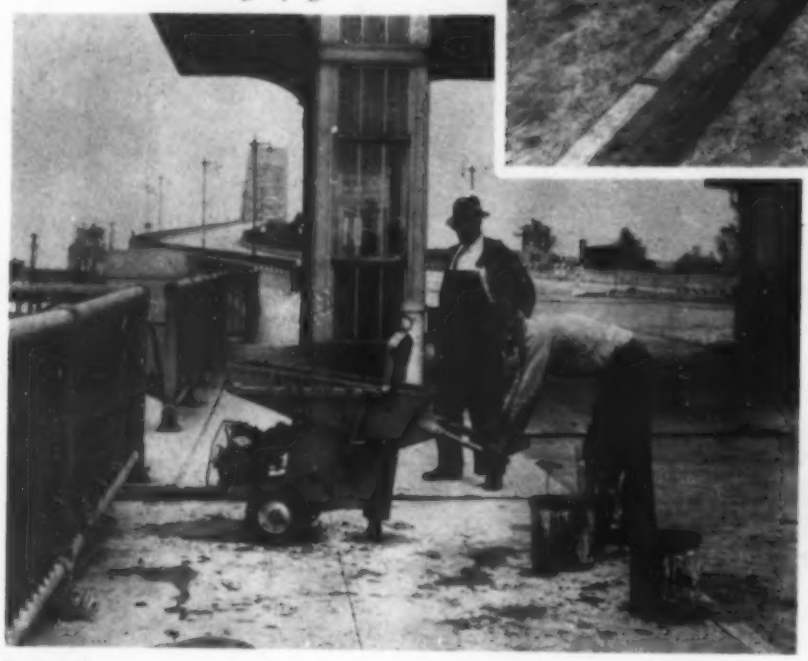


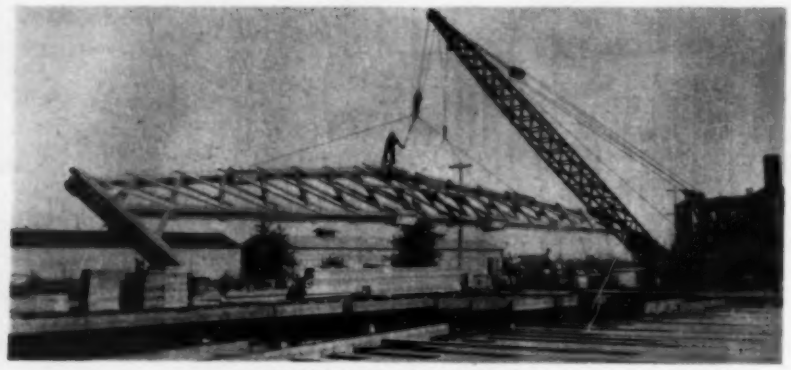
SETTLED PAVEMENT

on approach to Bayonne Bridge, New York *(below)*, is raised by National Equipment Corp., mud-jack which pumps under slab liquid mixture of one part cement to from 15 to 20 parts of loamy soil, mixed with water. Mud pumped at 100 lb. per square inch pressure through holes drilled in slab fills voids and raises pavement to proper grade. Cement in mix reduces shrinkage during drying.

EXPANSION JOINT

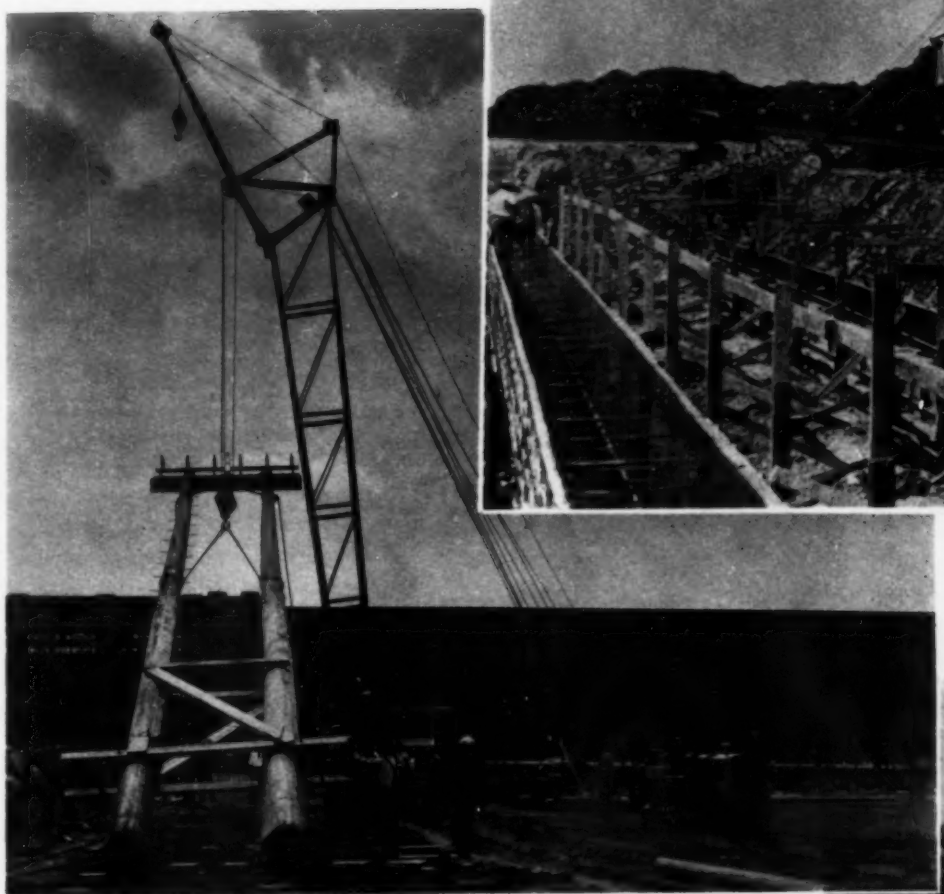
(left) in new concrete paving on Queensboro bridge, New York City, consists of steel castings with interlocking "fingers", providing for movement of 2½ in. either way from normal. Joints are installed at the distances of from about 450 to 550 ft. apart. Base of each casting is riveted to top flange of floor beam of bridge. Each casting is 5 ft. long, has fingers 1 in. wide and openings between fingers 1½ in.





ERECTED AS UNIT

Locomotive crane raises into place 112-ft. span Douglas fir roof truss with columns attached for warehouse at Port of Tacoma, Washington. Wood truss is fabricated with split ring connectors.

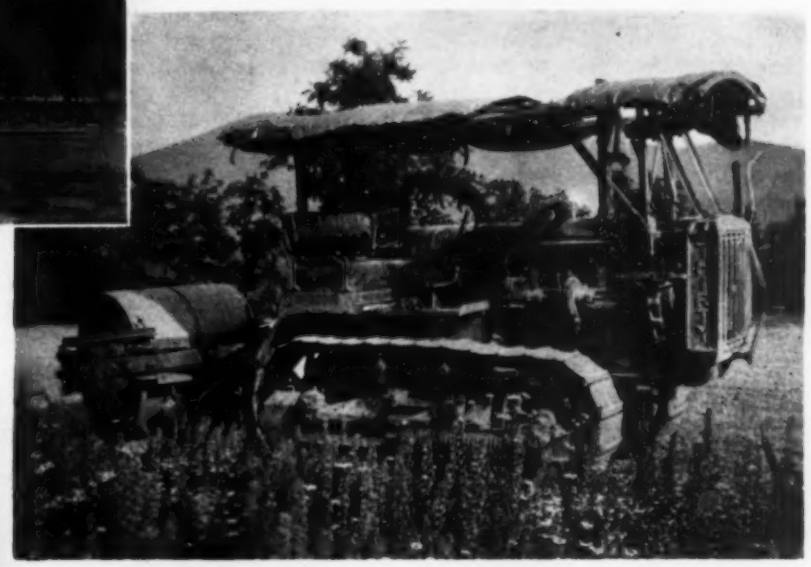


GOING UP!

Timber poles 72 ft. long for night lighting system at new athletic field in Peoria, Ill., are raised by Le Tourneau 2-wheel tractor crane powered by Caterpillar "30" tractor.

BELT CONVEYOR

with reach of 50 ft. delivers concrete from paving mixer riding on narrow preliminary fill into forms for walls of new Republic Steel Corp. wire mill at South Chicago, built by The Austin Co., of Cleveland.



FOR ROLLING ROAD SHOULDERS

on section of Skyline Drive, in Virginia, contractor devised this rig, consisting of front wheel of old steam roller hooked to a crawler tractor. — *Photo from* G. Y. CARPENTER, *Luray, Va.*

WELLPOINTS

of Moretrench type, driven along edges of timber sheeted pits for two bridge piers at Clay Center, Kansas, and hooked up with a pair of pumps, enabled holes to be kept dry and eliminated need for sealing at bedrock level prior to concreting.— *Photo from* H. L. KIPFER, *inspector, Kansas Highway Commission.*

WANTED — Photos of Details

The Editor of Construction Methods wants photographs or sketches illustrating interesting DETAILS of method or equipment and will pay for those he finds acceptable for publication.

Hasn't your job produced some DETAIL that might be illustrated on this page? Send along a picture of it; we'll return it promptly if we can't use it.

PIPE TRANSPORT RIG

consisting of truck and extension trailer, delivers 40-ft. welded lengths, 60 in. in diameter, for new 13-mile water supply line in St. Louis, Mo. Spinello Construction Co. uses Link-Belt crawler cranes to pick up pipe with Yellow Strand wire rope sling encased in rubber hose to protect pipe coating from damage by abrasion.

THIRTEENTH OF A SERIES OF ARTICLES

Planning and Plant for **HEAVY CONSTRUCTION**

Principles and Practices of Job Layout and Selection and Use of Equipment for Large Dams and Appurtenant Works

By ADOLPH J. ACKERMAN and CHARLES H. LOCHER
Construction Plant Engineer *Construction Consultant*
TENNESSEE-VALLEY AUTHORITY, KNOXVILLE, TENN.

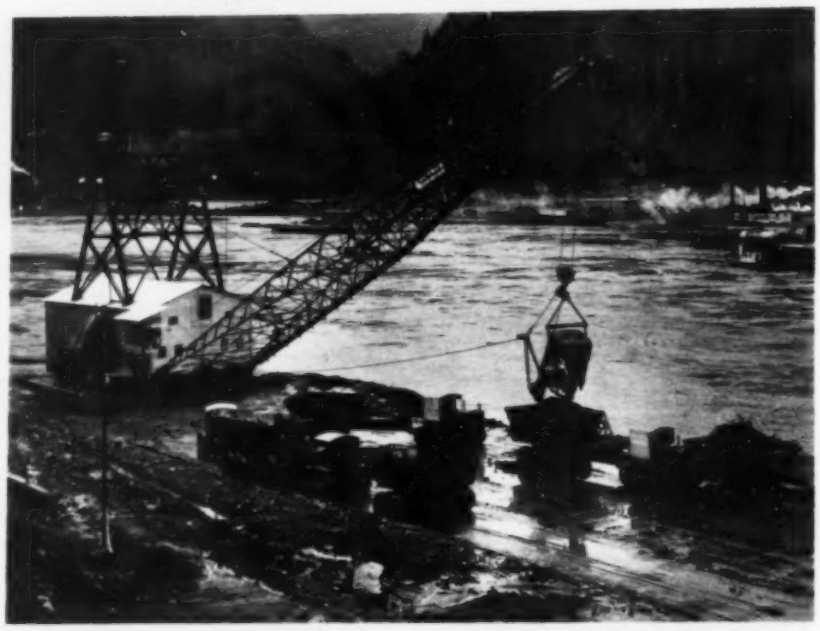
13 . . . Excavating Equipment (*Continued*)

THE ADAPTATIONS of a convertible shovel for clamshell bucket, ditcher or scoop work, are largely special machines and only rarely are they used as production units on an excavating job. The clamshell is particularly suited to cleaning out holes, reclaiming gravel and loading into bins. The scoop is essentially a clean-up tool from hard or level surfaces, while the ditcher largely supplements the continuous bucket ditcher where the material is too hard for the latter, or contains roots, stones or other foreign matter which requires more power for removal.

Walking Dragline — The walking dragline, as an excavating machine, is more or less in a class by itself. Its principal features include unusual simplicity of the traveling mechanism, simple structural design, large sizes, up to 12 to 14-yd. buckets on 175-ft. boom, and easy mobility. The machine can travel on soft bottom, its bearing pressure being only 4 to 6 lb. per square inch.

No steering mechanism is required as the machine always travels opposite to where the boom points, and changes in direction are quickly accomplished by swinging the revolving body. The machine is designed to be quite free from wet weather interruptions and has an exceptionally fast hoist and swing. High efficiency of operation is obtained, the time cycle for all sizes being less than 1 min. As a rule, diesel engines are employed, with remote control operating levers, either electric or air-powered.

Quite a number of these machines have been equipped with aluminum booms, which raise the cost of a machine about 5 per cent over one with a steel boom, but the weight reduction makes possible increases of 15 per cent in boom length, or 20 per cent in bucket capacity.



LONG-BOOM WALKING DRAGLINE excavating earth and gravel under water prior to cofferdamming for foundation preparation on Bonneville Dam. Note importance of large hauling units in relationship to size of bucket.

These machines have been particularly popular in the construction of levees and canals where their exceptionally long reach frequently permits digging and disposal in one operation or in some cases the material might be rehandled once or twice, thus eliminating the need for transporting equipment.

Typical performance records include a 5-W machine with oversize 8-yd. buckets and 80-ft. boom on the Florida canal, averaging 8,000 to 10,000 yd. per day, with a maximum of 14,690 yd. This machine has produced 260,000 yd. maximum per month and operates at an average yardage of 360 yd. per hour.

On the All-American canal in California four 10-*W machines with* 12-

WALKING DRAGLINES

Model Number	Bucket Size Standard (See note below)	Boom Length Standard	Diesel Power Unit Speed	Diesel Power Unit Power	Working Weight	Factory Price	Operating Dimensions Boom Angle 25 Deg. Digging Reach	Operating Dimensions Boom Angle 25 Deg. Digging Depth Standard Ropes	Operating Dimensions Boom Angle 25 Deg. Dump Height	Speeds Travel	Speeds Hoist	Average Cycle Time 110 Deg. Swing Earth	Average Cycle Time 110 Deg. Swing Gravel	Average Cycle Time 110 Deg. Swing Well Blasted Rock	Output At 100% Plant Efficiency Earth	Output At 100% Plant Efficiency Gravel	Output At 100% Plant Efficiency Well Blasted Rock
															Bucket Efficiencies		
															90%	90%	60%
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Cu.yd.	Ft.	R.P.M.	H.P.	Tons	Dollars	Ft.			M.P.H.	Ft. Per Min.	Seconds			Cu. Yd. Per Hour		
	1½H	35					38	18	8						162	147	82
1-W	1 H	40	650	80	35	17,000	42	20	9	0.28	112 to 112	30	33	39	108	98	55
	¾H	45					52	25	13						81	74	41
2-W	2 H*	60	360	110	73	31,500	62	32	15	0.23	151 to 129	36	40	47	180	162	92
	1½H	70					72	38	22						135	121	69
	3½H	60					65	29	14						252	230	128
3-W	3 H*	70	300	140	122	48,500	74	25	20	0.19	154 to 139	45	50	59	216	196	110
	2½H	80					83	21	24						180	164	92
	5 H	80					85	43	20						324	294	166
4-W	4 H	100	300	210	233	80,000	103	49	31	0.22	159 to 134	50	55	65	259	236	133
	3 H	120					121	38	41						194	176	100
	6 W	80					82	46	20						450	414	232
5-W	5 W*	90	360	250	150	68,500	91	52	26	0.18	160 to 140	43	47	56	376	345	193
	4½W	100					100	58	29						340	310	174
	6 H*	100					104	58	26						354	324	180
6-W	5 H	115	300	280	305	103,000	118	52	33	0.19	168 to 155	55	60	72	294	270	150
	5 H	125					127	48	37						294	270	150
	7 H	140					143	80	43						378	344	194
6160	6 H*	160	360	420	445	135,000	161	72	51	0.18	158 to 150	60	66	78	324	294	166
	5 H	175					175	64	59						270	245	139
	11 H	140					144	81	40						594	540	305
10-W	10H*	160	260	450	700	210,000	162	92	49	0.17	163 to 154	60	66	78	540	490	278
	8 H	175					175	94	56						432	392	222

H — Heavy Duty * — Standard Sizes W — Medium Duty

SLACKLINE excavator of Sauerman type digging gravel from river bed and storing it on shore.

elevated to a bank or a higher dumping point.

Excavators are generally adapted to cut to a depth of one-third of the span and lift the material 60 to 90 ft. above the top of the cut, depending upon the height of the excavator tower. The equipment consists of a drag bucket attached by chains to a carrier which runs on an inclined track cable. The equipment is usually arranged so that the bucket runs back freely when the track cable is pulled up tight. At the desired point, the cable is slackened and the bucket, pulled by the load cable, digs into the material until it is filled, when the track cable is again tightened and the loaded bucket rises and travels to the discharge point.

Table 4 gives the output of Sauerman excavators when digging sand or gravel at a digging speed of 200 ft. per minute, conveying speed of 600 ft. per minute, and a gravity return speed of 1,200 ft. per minute.

In the case of cableway drag scrapers the scraper is not raised after it has filled but is permitted to continue its travel on the earth and the bank on which the earth is dumped. The scrapers are particularly suited for building levees or for excavating a channel where the material may be dumped directly on the bank. In levee construction the output of the machine depends on its span and the height of the levee. The span is usually 500 to 750 ft. and the digging and hauling speed 450 ft. a minute. The return speed on short spans by means of gravity is 1,800 ft. per minute or 1,400 ft. per minute when the backhaul is powered. An accompanying table gives esti-

TABLE 4—CAPACITIES IN CU. YD. PER HOUR OF SAUERMAN CABLEWAY EXCAVATORS

Span (ft.)	Average length of haul (ft.)	Size of Bucket 1 yd.	2 yd.	3 yd.	3½yd.
400	250	52	100	156	182
600	350	44	88	132	156
800	450		72	108	124
1000	550		68	102	119

TABLE 5—HANDLING CAPACITIES (THEORETICAL) CABLEWAY DRAG SCRAPERS
(Cu. Yd. Per Hour)

Average length of haul, ft.	Size of Scraper 4 yd.	6 yd.	8 yd.	10 yd.	12 yd.
100	320	480	640	800	960
200	168	254	336	420	508
300	112	168	224	280	336
400	86	126	172	213	252
500	68	104	136	172	208

yd. buckets and 165- *to* 175-*ft. booms, operated by diesel engines, are digging at a contract price of* 8 *to* 12¼ *c. per cubic yard.*

Slack Line Cableway Excavators— The slack-line cableway excavator is essentially a tool which digs, conveys and elevates by means of a bucket running on a cable, the entire operation under the control of one man. This class of equipment is subdivided into two types, one known as cableway excavators and the other as cableway drag scrapers. This equipment is particularly suitable where the excavated material is to be hauled any distance from 150 to 1,000 or 1,500 ft. and

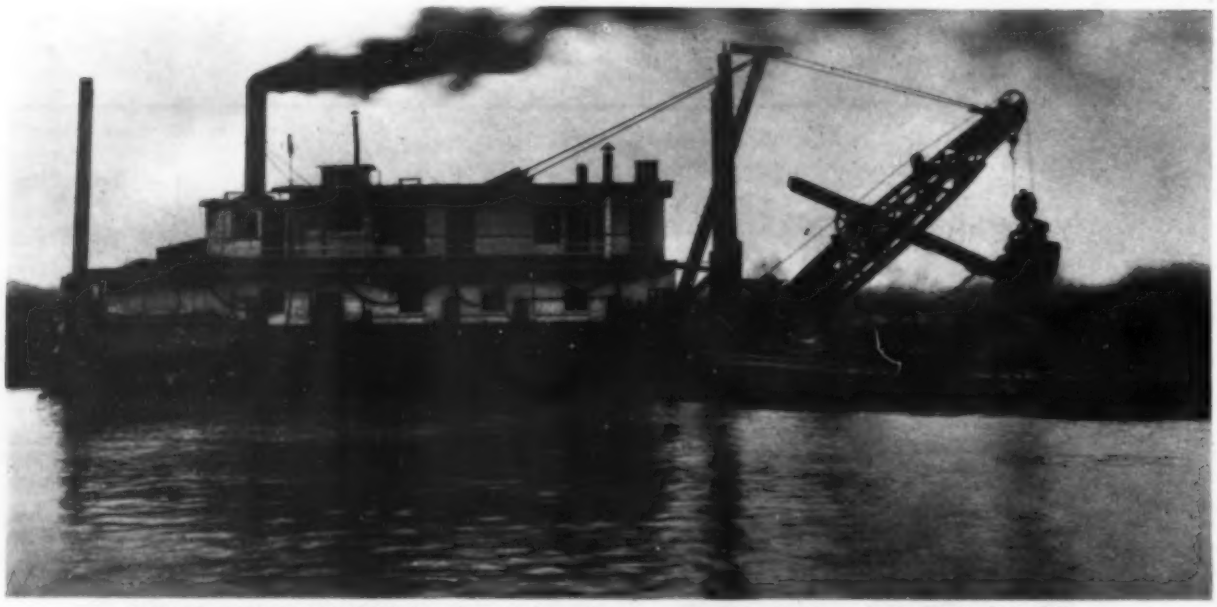
TRAVELING TOWER EXCAVATOR with 500-ft. span and 12-yd. bucket building levee on Mississippi River. Inset shows details of bottomless crescent-shaped bucket.

mated hourly capacities in cubic yards of different sizes of Sauerman scrapers operating in loose sand and gravel:

Hydraulic Sluicing—This method of moving earth utilizes streams of water at high pressure directed at the material through portable nozzles usually called hydraulic giants or monitors. The high velocity jets are generally directed against the foot of the bank to undercut the material and the water sweeps it to waste or into sumps or sluiceways. As a rule the water carries about 10 per cent solids. Performance generally depends on the pressure of the water for cutting the bank, the quantity of water and slope of sluiceway for transporting the material, the location of the nozzle with respect to the bank, the nozzle design, and general operating experience. Usual operating heads vary from 100 to 400 ft. and except for the fact that a large quantity of water is required, plant costs are normally quite low. Table No. 6 indicates water requirements for average installation.

In Trinity County, Calif., a highway grading job is being performed by means of hydraulic giants in moving

HYDRAULIC STRIPPING at Norris dam quarry with high pressure "monitor".



FLOATING DIPPER DREDGE for channel deepening here used to load earth for cofferdam filling at Wheeler dam. This type of dredge is sometimes convertible to dragline or clamshell service.

6,000,000 yd. of earth. The nozzles are exceptionally large, 7 and 8 in. in size, and water is supplied through a 26-in. line, branching to 18-in. lines which serve the giants. A head of 550 ft. delivers 60 c.f.s. per 8-in. nozzle, and approximately 800 yd. per hour are moved, the water carrying about 10 per cent solids.

Considerable care is required in the design and layout of the pumps. Sometimes it is advisable to provide a low-head pump to augment the transporting power of the water. Where the material is sluiced into pipe lines it is possible to transport the mixture on as flat a grade as 1¾ per cent, while on ground sluices with planked sides, a 4-per cent natural grade and sometimes as low as 2½ per cent to 3 per cent, will carry the materials, which, depending upon their nature, may vary from 8 to 20-per cent of solids. In excavating clay, sharp nozzles such as 2½-in. at high pressures up to 400 ft. are effective in moving from 50,000 to 60,000 cu. yd. per month.

TABLE 6—WATER REQUIREMENTS, HYDRAULIC SLUICING

Nozzle diam. inches	Discharge in c.f.s. Head in feet 100	200	300	400
2	1.60	2.25	2.75	3.25
3	3.60	5.10	6.25	7.25
4	6.50	9.25	11.25	13.0

Dipper and Clamshell Dredges—For subaqueous shallow excavating, such as channel deepening or other operations where it is necessary to remove rock or material containing large boulders, this type of equipment is quite effective, although it does not have the output of other types of dredges. A 2-yd. machine will excavate about 100 yd. per hour, and a 4-yd. machine about 200 yd. per hour. Normally the capacities of this equipment are about one-half of equivalent dry excavation.

Ladder Dredge—The ladder dredge is equipped with a powerful bucket elevator mounted on a steel ladder about 50 ft. long and extending down to the river bottom. The end of the ladder may be raised and lowered for inspection. This type of dredge is particularly suited to digging gravel, which may be processed on the same unit. The equipment is usually large and expensive and, like most types of dredges, is not as a rule equipped with towing apparatus, a special towboat being normally used to move it. The ladder generally travels at about 60 ft. per minute and with a capacity of 3 cu. ft. per bucket the output of the dredge is 100 cu. yd. per hour. A line of 5-cu. ft. buckets delivers 200 cu. yd. per hour and one with 8-cu. ft. buckets, 350 cu. yd. per hour.

Suction Dredges—The elements of an hydraulic suction dredge consist of an engine or motor-driven pump mounted on a barge, a suction line from the pump supported on a ladder and extending down into the subaqueous formation, this ladder being hinged for raising or lowering. Some dredges are equipped with motor-driven cutterheads, which cut and churn the material prior to its entrance into the suction line. The discharge line is supported on pontoons and connects with the shore line which runs to the desired discharge point. At the rear of the dredge steel spuds serve as pivots about which the dredge swings as it cuts into the material. The suction line is usually 3 to 4 in. larger than the discharge line to maintain a vacuum on the pump when discharging on a short pipe line.

Most dredges have a life of 15 to 20 years and while invariably of special design, certain principles of general purpose design should be employed to

adapt the dredge to a wide range of work. The pumps and runners are made of special wear-resistant material.

Under normal conditions the solids run from 8 to 15 per cent. As a general rule, the size of the solids determines the size of the pump, although when the capacity of larger pumps is not necessary it is more economical to use cutterheads with narrow slots, or a stone box ahead of the pump. The output of a dredge is exceedingly variable, depending upon the size and kind of material, the pipe line size and length and static head, the suction pipe size and lift, and the available power. On the Miami Conservancy District a 15-in. pump averaged around 300 to 400 yd. of gravel per hour, whereas the range was from 250 to 600 yd. per hour. Similar ranges of performance have been reported by experienced operators. O. P. Erickson, of the Great Lakes Dredge & Dock Co., gives these figures:

> "A 26-in. dredge with 1,600-hp. pump in about 23 hr. pumped over a line 1,250 to 1,800 ft. long and with an 8 to 9-ft. rise, 53,000 yd. of sand and mud, but only 9,500 yd. when digging hard clay mixed with large clamshells. Similarly a 30-in. dredge with a 3,000-hp. pump was able to pump sand and mud a distance of 15,000 ft., but could pump gravel only 5,000 ft."

Among the precautions to take in starting up a new dredge is the necessity of an experimental run in which to tune up the unit, remove most of the normal difficulties, and determine the most efficient point of performance. Graphical records and instruments are particularly useful at various points on the equipment where efficiency is not readily detected otherwise, and performance charts should constantly be analyzed by competent personnel. The best speed and output relationship should be determined for a combination of conditions. Sometimes it may be necessary to change cutters to suit the material, and the correct speed of the cutter is of particular importance. Changing the size of the suction pipe may improve the output. Fort Peck experience indicates that a larger suction line and lower suction lift increased the output. A 35-in. suction is now being used with a 28-in. discharge line. Considerable expense is justified in preventing excessive sizes of stone, wood, or other foreign particles from reaching the pump. An adequate supply of replacement parts, constantly available and properly timed for installation, is a major phase of dredge management.

Summary — The reader is cautioned in the use of performance data presented in this chapter. Such data is intended to be relative, to give a reasonably comparative picture, but application to a particular job requires a full analysis of all local conditions. *Hourly* rates of output can seldom be maintained over more than a day. Such figures are important in laying out related plant units for balanced performance in a chain of operations, but the large list of variables which affect the output of excavating equipment often permits the *monthly* output to be only 50 to 70 per cent of the optimum ability of the plant.

❖

NEXT CHAPTER in February.— Because January issue of "Construction Methods" will be the annual Road Builders' Number the next chapter (No. 14) of the series on "Heavy Construction," by A. J. Ackerman and Charles H. Locher will appear in the February, 1937, issue; it will deal with "Transportation Equipment."

Suction Dredges—Average Sizes and Performances*

Discharge Pipe Diameter	Average Pump Hp. Ratings (For Cutter & Swing Add 25%)	Velocity for Normal Operation	Max. Length of Horizontal Pipe for One Pump & Heavy Material	Cu. Yd. Normal Output Per Month of 25 Days at 24 Hr. Per Day		
In.	Hp.	Ft./Sec.	Ft.	Light Material	Medium Material	Heavy Material
6	100	15	720	50,000	21,000	7,000
8	180	15	1,050	80,000	33,000	12,000
10	290	15	1,400	115,000	50,000	17,000
12	430	15	1,800	170,000	70,000	25,000
14	600	15	2,250	235,000	100,000	35,000
16	810	15	2,750	310,000	130,000	45,000
18	1,060	15	3,350	400,000	170,000	58,000
20	1,340	15	3,890	500,000	210,000	72,000
22	1,670	15	4,500	600,000	250,000	87,000
24	2,050	15	5,150	730,000	305,000	105,000
26	2,450	15	5,800	860,000	360,000	124,000
28	2,900	15	6,650	1,000,000	420,000	144,000
30	3,450	15	7,600	1,170,000	500,000	170,000

*This table represents average conditions and is largely relative. Specific problems must be analyzed in terms of local conditions and nature of material.

LADDER DREDGE with continuous bucket chain digging gravel in river bed. Screening plant on dredge processes gravel and loads classified materials into barges.

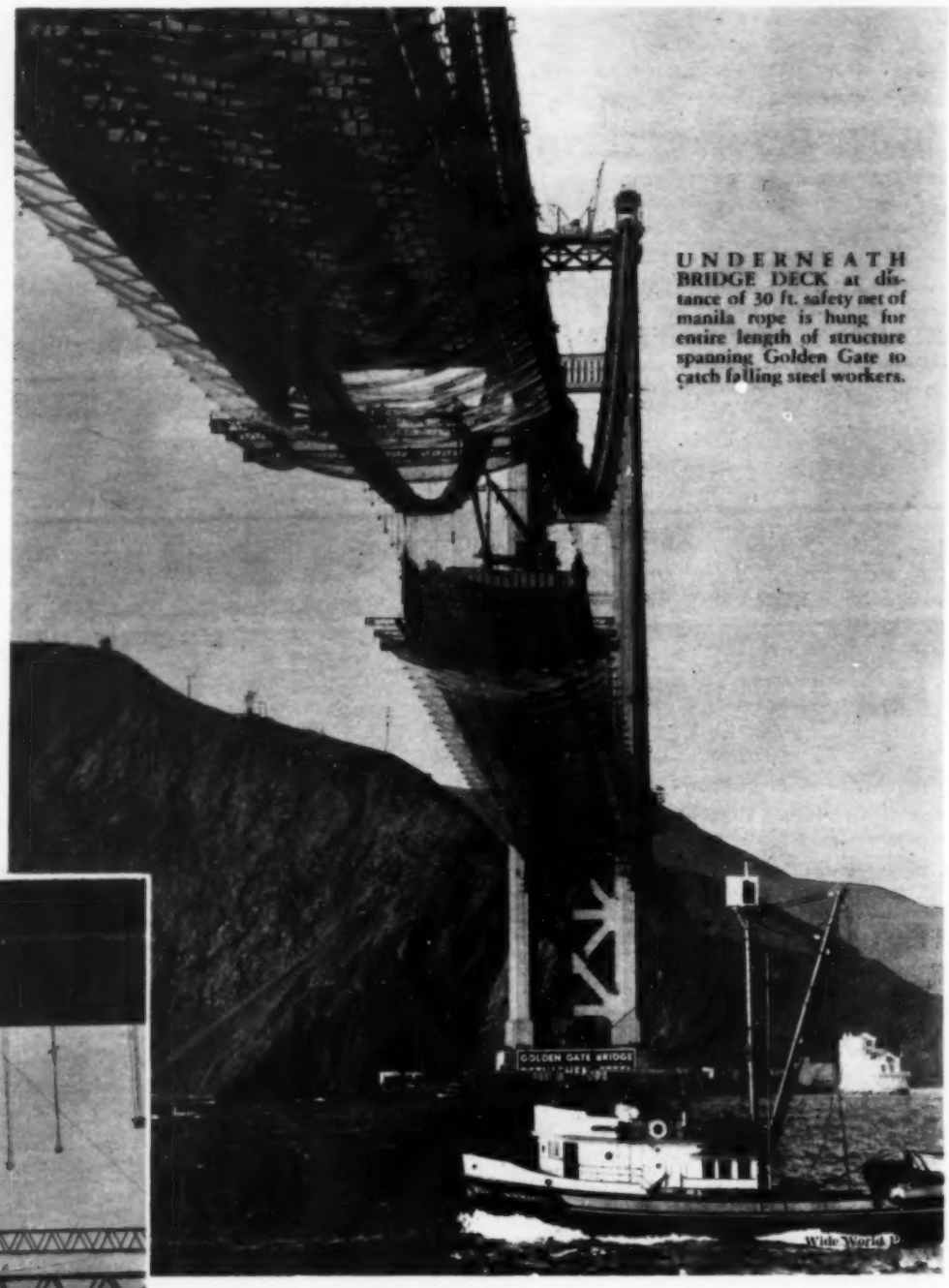
SUCTION DREDGE (16 in.) with motor-driven cutter-head for excavating lock and power-house sites at Pickwick Landing dam and pumping material into earth fill dams.

SAFETY NET Protects Bridge Workers

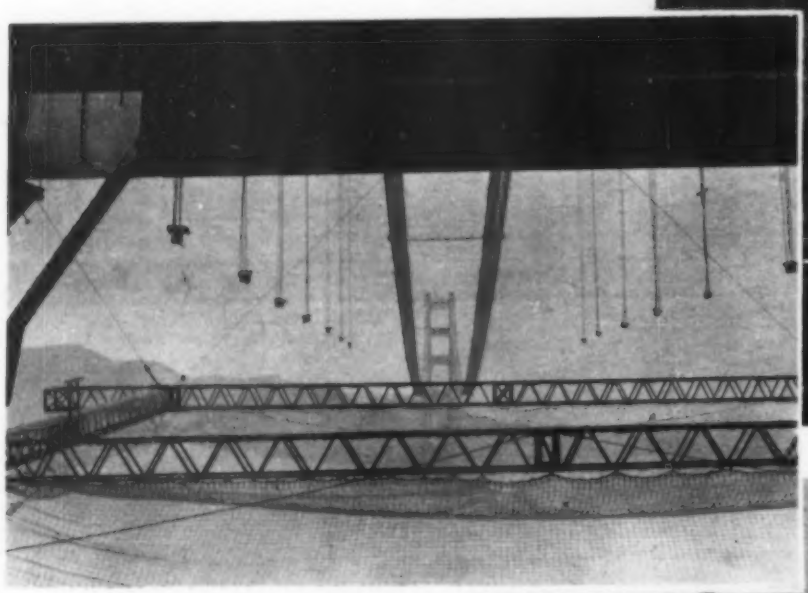
TO PROTECT STEEL ERECTORS on the 4,200-ft. main suspension span and side spans of the Golden Gate bridge, San Francisco, a huge net of the type used to safeguard aerial performers in a circus has been hung underneath the structure to catch workers who might slip and fall 250 ft. into the bay. The safety net, 120½ ft. wide and about 6,400 ft. long, is made of ⅜-in.-diameter manila rope with a 6-in. mesh, large enough to permit hot rivets to pass through. As the bridge is 90 ft. wide, the net extends 15 ft. beyond the roadway at each side.

As installed by the McClintic-Marshall Corp., which has the contract for the erection of the bridge superstructure, the net is in two parts, a traveling section about 126 ft. long and 121 ft. wide and a stationary section 120½ ft. wide. The traveling section is hung directly below the point at which the erection of bridge steel is in progress; it is attached to a metal frame and cables suspended from wheels riding on the upper member of the deck truss, so that it can be moved along as work progresses. As the traveling net moves along while the bridge deck is extended the stationary net, in sections 52 ft. long, is unfolded and hung about 30 ft. below the bridge structure for its entire length.

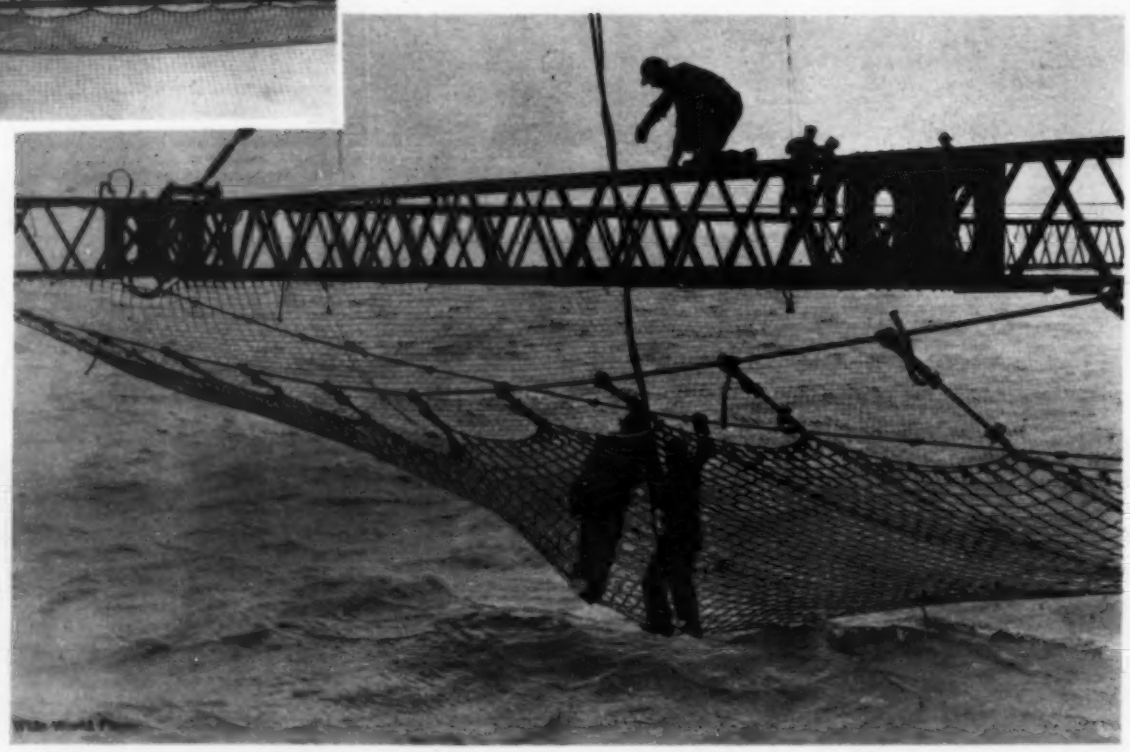
Tests of the safety net were made by dropping upon it from a height of 53 ft. loads of 400 lb., consisting of four bags of sand tied together.



UNDERNEATH BRIDGE DECK at distance of 30 ft. safety net of manila rope is hung for entire length of structure spanning Golden Gate to catch falling steel workers.



TRAVELING SECTION of safety net is suspended under steelwork in advance of installation of stationary net.



MESH of 6 in. is small enough to hold men and large enough to pass hot rivets falling from structure.

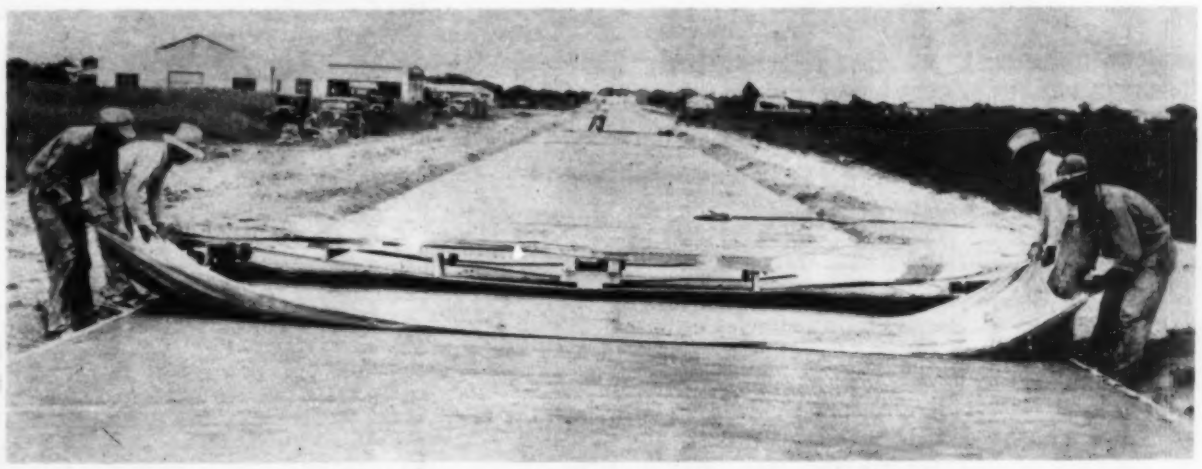
COTTON MATS for Curing Concrete

COTTON MATS for curing concrete pavement slab are usually 22x6 ft. in size.

ROAD BUILDERS' interest in the current government-sponsored demonstration of concrete curing by the cotton mat method now being conducted in a score or more of states is heightened by the Texas Highway Department's recent report to the Cotton-Textile Institute of its successful use of the mats since 1933. More than 80,000 mats, similar to those used by the Texas department, have been distributed by the U. S. Bureau of Public Roads to 22 states.

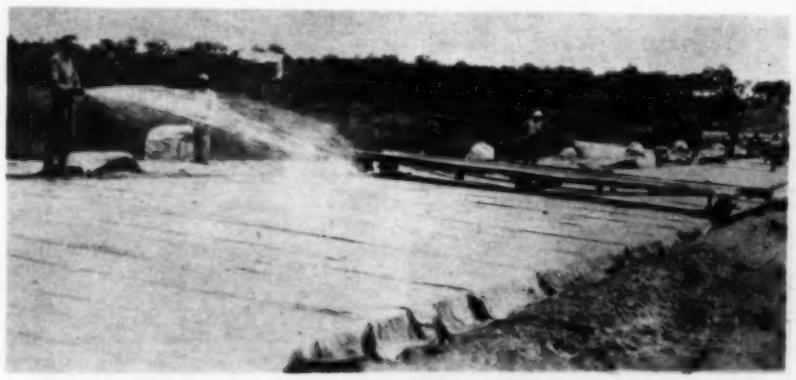
While specifications for the mats vary among the several states according to local conditions or requirements, most of them are approximately 22x6 ft., made of a coarse cotton fabric filled with 8 oz. or more of cotton per square inch. In Texas the former standard practice had been to cover "green" concrete with wet burlap over which was used wet earth or ponded water. Either method, according to the department's report, required at least 10 days of constant attention and the cost of curing ranged up to 4c. per square yard.

Using cotton mats, the Texas Highway Department found that freshly laid concrete can be cured in not to exceed 72 hr. with a saving of from 15 to 25 per cent, not to speak of the definite economy represented by the re-use of the mats for from 75 to 100 placements. The cotton mat cured pavements in two cases cited by the department showed compressive strengths of 5,030 and 4,438 lb. per square inch as against 4,587 for a burlap-earth cured section and 4,137 for a burlap-ponded water cured pavement.



PLACING of cotton mats is done by four workers, one at each corner.

TRAVELING CARRIAGE riding on wheels along forms carries mat units to place.



SPRINKLING with water keeps cotton mats moist during period of curing.

JOINT FILLING *(right)* can be done readily by rolling back edge of cotton mat.

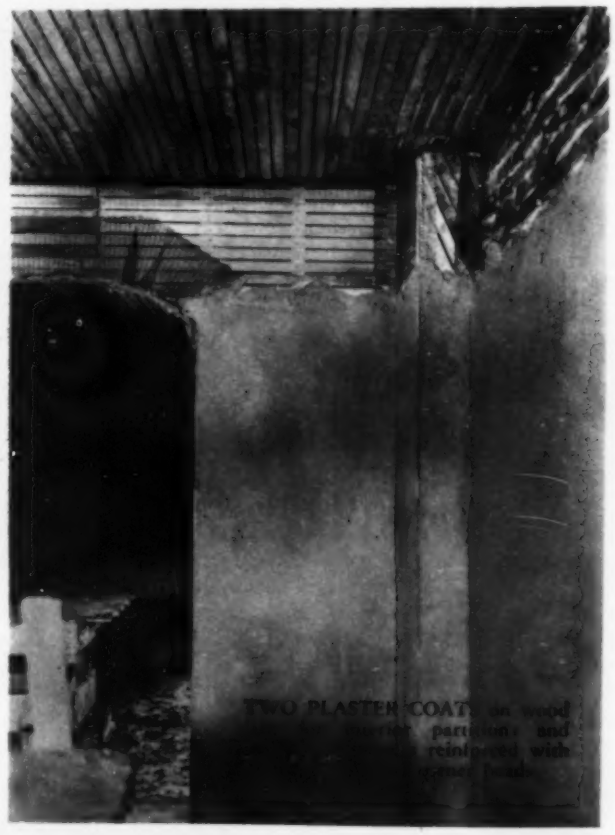
RE-USE makes cotton mats economical. This unit was used for 58 placements on 6 different projects over period of 352 days.

$660 Down; $37 a Month

IS IT A BUY?

STONE MASONRY WALLS for foundations and porches and stucco on paper-backed wire mesh for front gables lend variety to brick exterior. Roof at front of houses is slate.

SOLID-ROW HOUSE CONSTRUCTION in Baltimore enables builder to erect 30 six-room and basement dwellings on plot 450 ft. long and to sell units for $3,290, exclusive of land, which remains in builder's ownership at fixed annual rental under ancient Maryland law authorizing this arrangement. Sound construction embracing brick masonry bearing walls assures low maintenance charges in addition to low heating costs in solid-row houses.



FOR ECONOMY in construction, heating and maintenance, house builders have discovered nothing to surpass solid-row construction of masonry-wall dwellings as practiced in Baltimore and other eastern seaboard cities. James Keelty, experienced and reputable operative builder of Baltimore, recently constructed a row of 30 six-room houses which could be purchased under FHA guaranteed mortgage with a down payment of $658 and monthly payments of about $37 over a period of 20 years. The monthly payment includes interest, taxes, insurance, payment on principal, and that Baltimore peculiarity, ground rent. Practically all the houses were sold before they were completed.

According to the system of ground rents, as practiced in Baltimore since early Colonial days, the owner of land retains his ownership, if he so wishes, even though he sells a house built upon the property to another person. The annual rent to be collected from the land is unalterably fixed. According to a recent law enacted by the General Assembly of Maryland, the owner of the house at the end of five years can compel the owner of the land to sell the property at the capitalized value of the annual ground rent, which normally is set at 6 per cent of the fixed land value.

Ground rent for each of the 30 houses in the Keelty row amounts to $75 a year, and the capitalized valuation of each parcel of land is $1,250. Baltimore home owners in general are said to prefer to allow the fixed ground rent to continue rather than to purchase the land on which their houses are built. The city has a very high proportion of home ownership, and it is a question whether solid-row construction and ground rent have not assisted in bringing about this desirable condition.

Cash purchase price for a house in the Keelty row (exclusive of land) is $3,290. Each house, erected on a lot 15 ft. wide by 100 ft. deep, has plan dimensions of 15x45½ ft. Foundation walls are of stone masonry 12 in. thick, and brick walls (both exterior and party) are 9 in. thick. Floor joists and roof rafters 8 in. deep are set into the masonry walls on 16-in centers. The basement has a concrete floor and is fitted with toilet, wash tubs and a coal-burning furnace which supplies hot-water heat to cast-iron radiators throughout the house.

ROOF RAFTERS and floor joists are set into solid brick masonry party walls. Red oak t.&g. flooring is laid on rough board sub-floor. Rooms are 14 ft. wide.

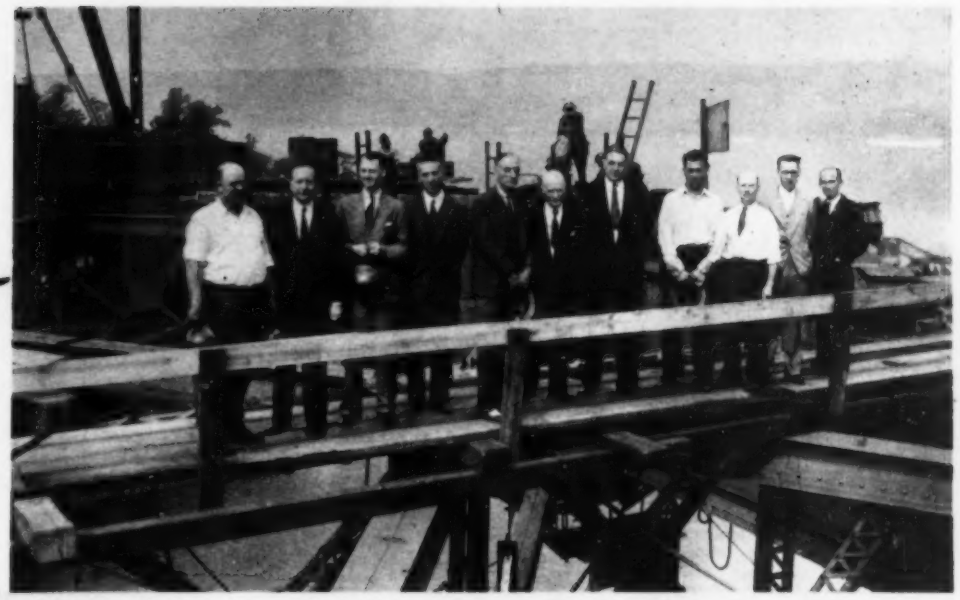
Roofing at the front of the house is slate, but on the sloping roof running from the ridge to the rear the covering consists of three-ply built-up roofing. Down-spouts in the front are copper and in the rear are galvanized steel. The roof of the front porch is slate. Porch steps are precast terrazzo, and the floor, measuring 8x15 ft., is tile. Exterior woodwork receives three coats of paint. Copper flashing is used throughout.

Floors of both the first and second story have sub-floors and red oak tongue-and-groove finish flooring. Floors are shellacked and waxed, and walls and ceilings are papered with a good grade of wall paper. Tile is used in the bathroom and inlaid linoleum in the kitchen. The typical house has eleven double-hung windows.

Present and Accounted For—

A PAGE OF

Personalities

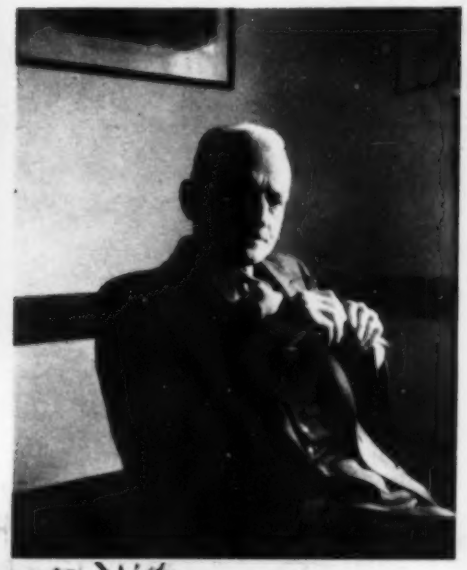


CLOSURE OF HENRY HUDSON BRIDGE

world's longest fixed steel arch (800 ft.) over Harlem River, New York City, is witnessed, July 8, by *(Left to right)* D. M. Wood, superintendent, American Bridge Co.; D. B. Steinman, Robinson & Steinman; Waldo G. Bowman, associate editor, *Engineering News-Record;* D. S. Fine, assistant to general manager, American Bridge Co.; F. H. Frankland, chief engineer, American Institute of Steel Construction; H. D. Robinson, Robinson & Steinman; E. H. Praeger, chief engineer, Madigan-Hyland; H. W. Knox, resident engineer, Madigan-Hyland; O. C. Diehl, resident engineer, W. K. Greene and Henry Leon, assistant engineers, American Bridge Co.

GAVEL CHANGES HANDS

as D. B. STEINMAN, (left) of Robinson & Steinman, consulting engineers, New York City, retiring president of National Society of Professional Engineers, welcomes his successor in office, ARTHUR V. SHERIDAN, engineer of design for Borough of the Bronx, New York, at society's second annual convention in Washington, D. C., Oct. 12.



SAFETY HEAD

(left) At its recent annual meeting, the National Safety Council reelected to the chairmanship of the Construction Section WELTON A. SNOW, safety director of the Associated General Contractors of America, Washington, D. C.

NEW COMMISSIONER

of New York City's Department of Water Supply Gas & Electricity is JOSEPH GOODMAN *(below)* formerly chief engineer and for 35 years in the service of the department. The promotion is noteworthy in its recognition of engineering fitness rather than political expediency for an important administrative post of this sort.

Photo, U.S. Steel News

LAST STEEL FOR BAY BRIDGE, SAN FRANCISCO

A 6x68-ft. floor beam weighing 9 tons, serves as background for group of engineers and steel erectors on 8¼-mi. structure linking San Francisco and Oakland, Calif., for which Columbia Steel Co. had general contract and American Bridge Co. had fabricating and erecting contract.

(Front row, sitting, left to right) H. C. Hunter, division erecting manager, American Bridge Co.; F. M. McAuliffe, attorney, Dept. Public Works; F. A. EnEarl, field engineer, American Bridge Co.; J. R. Fox contracting manager, Columbia Steel Co.; S. D. Jackson, division casualty manager, American Bridge Co. *(Back row, standing, left to right)* H. M. Gage, field paymaster, American Bridge Co.; Walter Shelton and J. W. Preston, attorneys, U. S. Steel Corp.; I. O. Jahlstrom, resident engineer, C E. Andrew, bridge engineer, C. H. Purcell, chief engineer, and G. B. Woodruff, engineer of design, Dept. Public Works; Otto Schultz, asst. supt., American Bridge Co.; A. N. Diehl, president, Columbia Steel Co.; A. Gerske, Pacific Bridge Painting Co.; W. J. Ward, supt., J. T. Martin, asst. engineer, J. A. Bergman, chief electrician, W. F. Beeman, field engineer, and W. S. Jarvis, foreman, American Bridge Co.

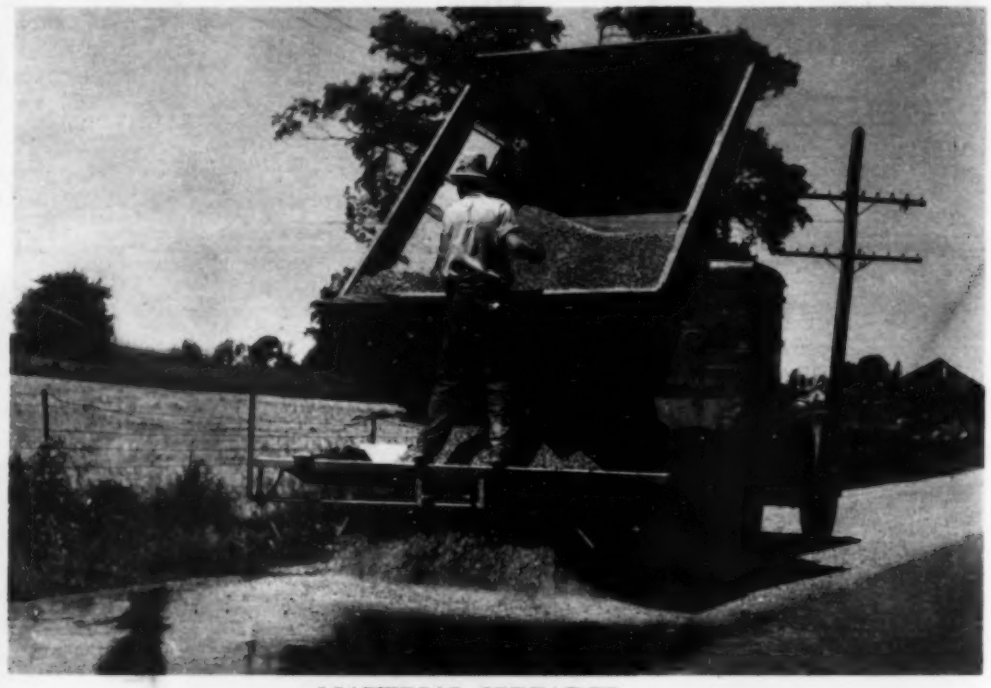
Construction Equipment News

(All rights reserved)

Review of Construction Machinery and Materials for December, 1936

LIGHT-WEIGHT CORE DRILL

for use in general contracting is 4 ft. 7 in. high, weighs about 1,000 lb. and offers 50 per cent increase in drilling speed. It consists of four parts — hoist, engine, swivelhead and frame and can easily be dismantled for transporting from job to job. Hydraulic or screw-feed swivelhead can be set for drilling at any desired angle. Variable speeds assure efficient operation in either soft or hard ground. Gasoline or electric drive.—Sullivan Machinery Co., Michigan City, Ind.



MATERIAL SPREADER

handles dust, screenings, pea gravel, chips and dust laying chemicals on macadam and black-top construction and maintenance and distributes cinders, salt, sand or chemicals for anti-skid work. Device is attached to back of dump truck, materials being dumped through opening in end gate into large hopper. Material discharges through manually controlled measuring gate in hopper on to whirling or revolving disk which casts material on to ground in circular or umbrella-shaped shower of material. Balloon tire traction furnishes power for whirling disk. Spreader is equally efficient in backward or forward direction. Width of spread varies from 3 ft. on shoulder work to 30 ft. on anti-skid work. — All-Purpose Spreader Co., 326 Sixth St., Elyria, Ohio.

BITUMINOUS DISTRIBUTOR

for applying all types of asphalts, cut-backs, emulsions, road oils and tars evenly and at specified quantity is equipped with fifth-wheel type tachometer which enables truck operators to gage required speed. Similar tachometer on pump regulates speed of auxiliary engine permitting synchronization of pump and truck so that gallons applied to road and square yards covered are according to specifications. Micrometer control on auxiliary engine governor gives close speed adjustment. Machine equipped with improved type of air blowing which automatically removes material remaining in spray bars and nozzles at end of each application, thus eliminating dripping after spray nozzles are shut off. Light-weight and heavy-duty models.— Kinney Mfg. Co., 3529 Washington St., Boston, Mass.

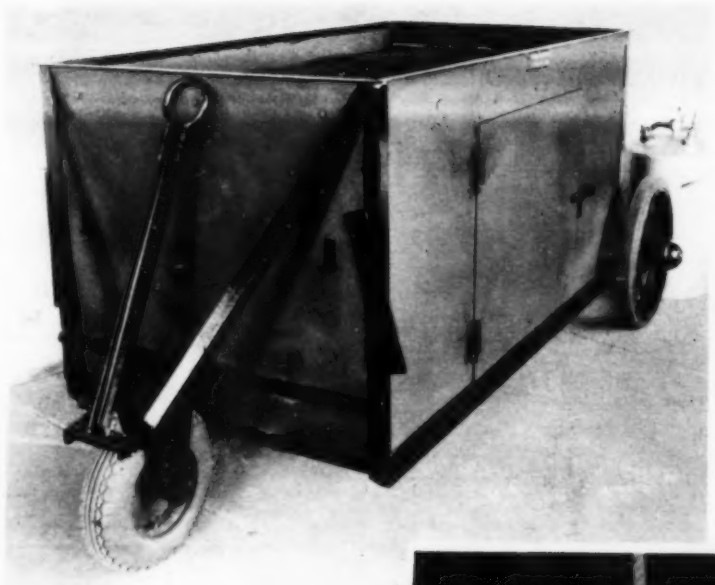
PIPE CLAMPS

(below) for stopping leaks in pipes of all types under any pressure or operating condition are made of malleable iron, heavily enamelled and fitted with cadmium-plated steel bolts and rubber gaskets. Clamps are tested under pressure of 3,000 lb. Gaskets which come in contact with contents of pipe line are made of material which will stand up under action of particular fluid or gas in pipe. Applied while pipe lines are in service except on extremely high-pressure lines. Sizes, ½ to 12 in.; lengths from 3¼ to 12 in.— M. B. Skinner Co., South Bend, Indiana.

If You Want Further Information

Within the space limits of this page it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them.



ROCK ASPHALT HEATER

(left) consists of all-steel box or heating chamber, mounted on wheels or plain steel skids. Near top of box is heavy wire mesh screen on which rock asphalt is dumped or loaded. Immediately under screen is inverted V heat deflector which prevents direct flame contact with bituminous material. As material becomes warm and dry it drops through screen into lower compartment from which it may be shoveled through large hinged door. Heat is furnished by White self-generating burner. Fuel is supplied from 15- or 20-gal. kerosene tank. — White Mfg. Co., Elkhart, Ind.

LIFE LINE GRAB

one-piece, non-ferrous, non-corrosive fitting with 65,000 lb. per square inch tensile strength, is automatic life-line adjuster for use of construction men, steeplejacks and others who work at great heights Obviates necessity of adjusting slack and of carrying many pounds of rope. Life line is threaded through grab which is attached to "D" ring of safety belt by government tested, drop-forged link. As man moves about his work life line travels freely through grab. In case of fall, grab trips up, holds and locks life line in tapered grooves, snubbing rope instantly and holding workman by safety belt. Recommended for use with ⅝- and ¾-in. long fiber manila rope. — American All-Safe Co., 210 Franklin St., Buffalo, N. Y.

ZONE MARKING SYSTEM

for streets and highways, called "Refract-O-Lite," utilizes principles of refraction and reflection by use of super binder-paint in which is embedded coating of tiny glass spheres to form hard, pebbly surface that will withstand severe road and weather conditions. Glass spheres act as tiny mirrors when car headlights strike them at night and present to motorist a solid streak of silvery non-glaring light enabling him to keep in proper traffic lane. Paint applied with any road marking machine to which is attached distributor designed to lay glass spheres evenly over wet binder-paint. Can be applied on any surface and in any color. Provides firm grip for automobile tires and helps to prevent skidding. —Fred H. Korff, Inc., 450 Seventh Ave., New York.

HARDWOOD FLOORS *(right and below)* called "Parkay," pre-fabricated and finished at factory and delivered to job in corrugated pasteboard cartons, consist of individual 4x2 and 2x2 in. hardwood blocks of standard 5/16-in. thickness assembled in basket-weave pattern and held together securely in semi-pliable grill. Laying operation as follows: First, a layer of adhesive; then a layer of felt, another layer of adhesive and finally the hardwood floor sections, ready for use as soon as put in position. Can be installed in average-size room in 4 or 5 hr. Available in light and dark oak and walnut and in East Indian teakwood. Delivery cartons each contain eight 2x6-ft. sections. — Wood-Mosaic Co., Inc., Louisville, Ky.

PNEUMATIC-TIRED TRAILERS

in pairs *(below)*, drawn by truck tractor, haul 80,000 lb. of coal each trip from mine to tipple at Sahara Coal Mines in Illinois. Use of these units saves cost and time required for track laying and roadbed construction; with three of them in operation shovel can load 5,000 tons of coal per 7½-hr. shift. To provide maximum capacity, structural weight was held to minimum by employing alloy steels of greater strength and durability. Trail car design is evolution of hopper-type coal car, and units are built to duplicate lifetime performance of their steel-wheeled predecessors. — Austin-Western Road Machinery Co., Aurora, Ill.

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ARMOR-D HANDLE

ORDINARY HANDLE

Armor-D

The Perfect Shovel Handle

The cross-section view of an ordinary handle and of an Armor-D handle, illustrated at left, clearly shows why the Armor-D is a superior handle.

Note that in the Armor-D the wooden fork extends to the top of the handle, encased in an armor of steel reenforcing the natural strength of second growth Northern Ash. The ordinary shovel handle is just riveted on the end of the handle stem — merely an extension.

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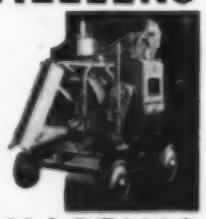

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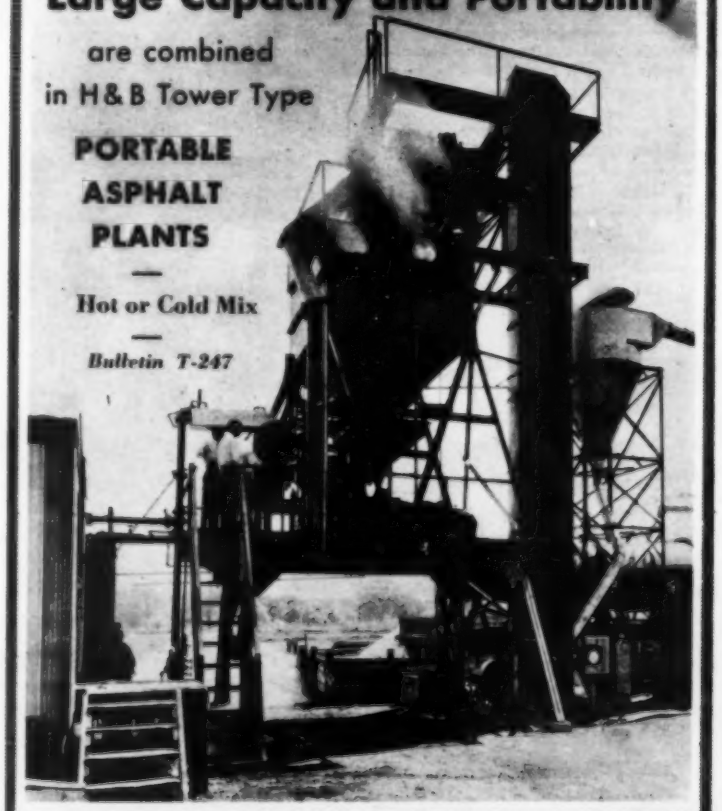

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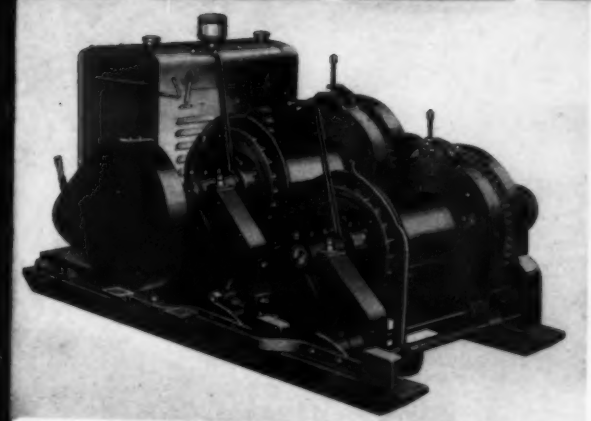

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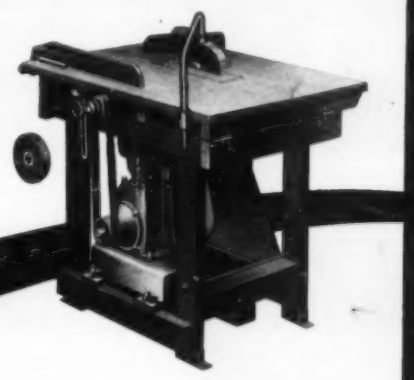

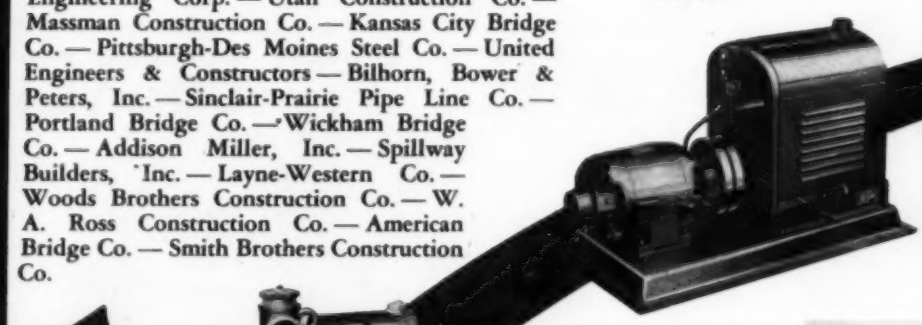

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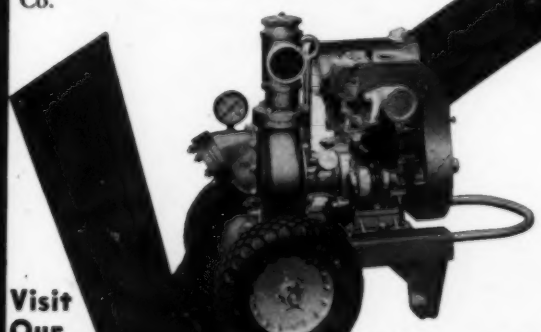

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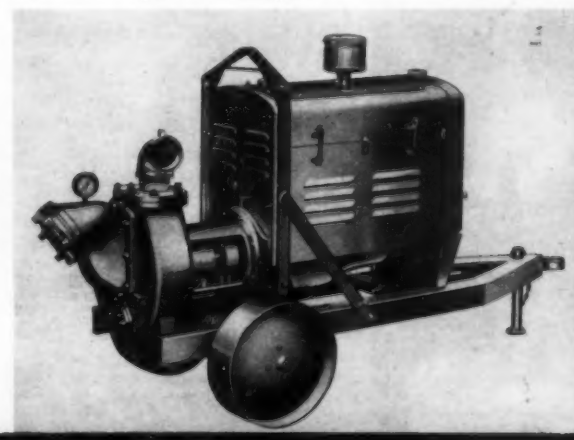

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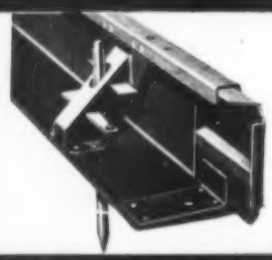

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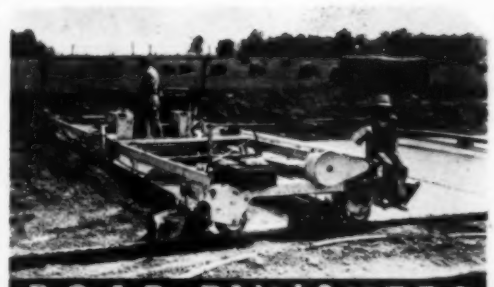

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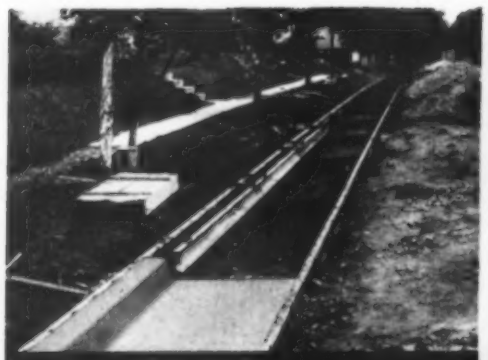

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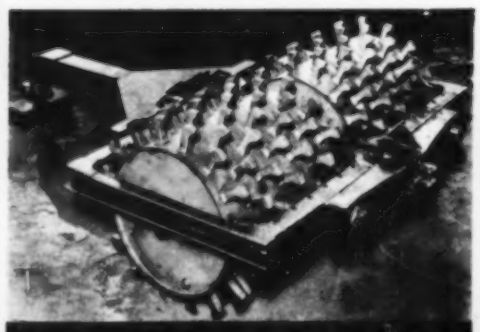

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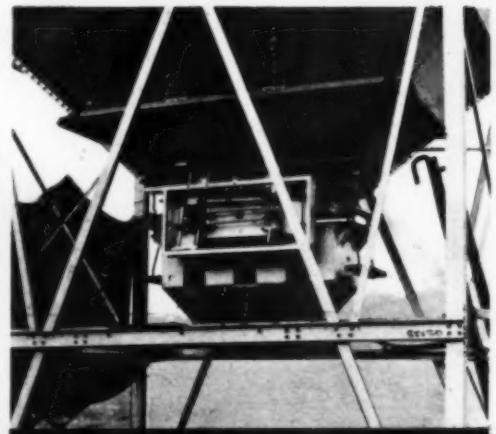

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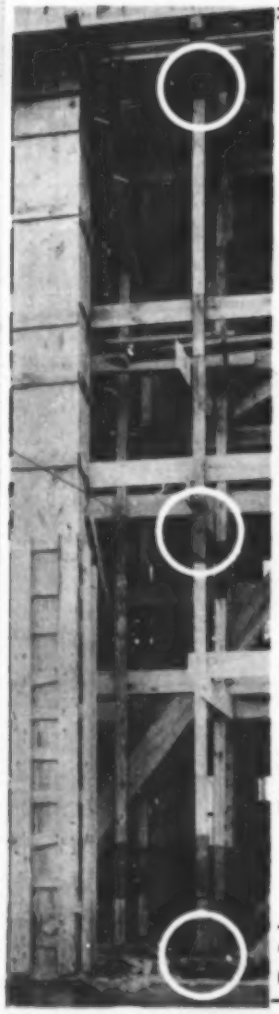

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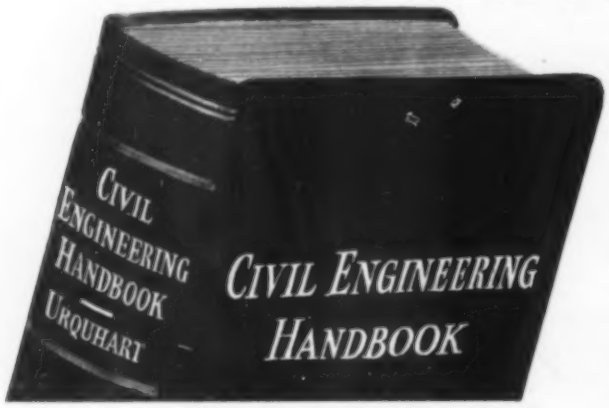

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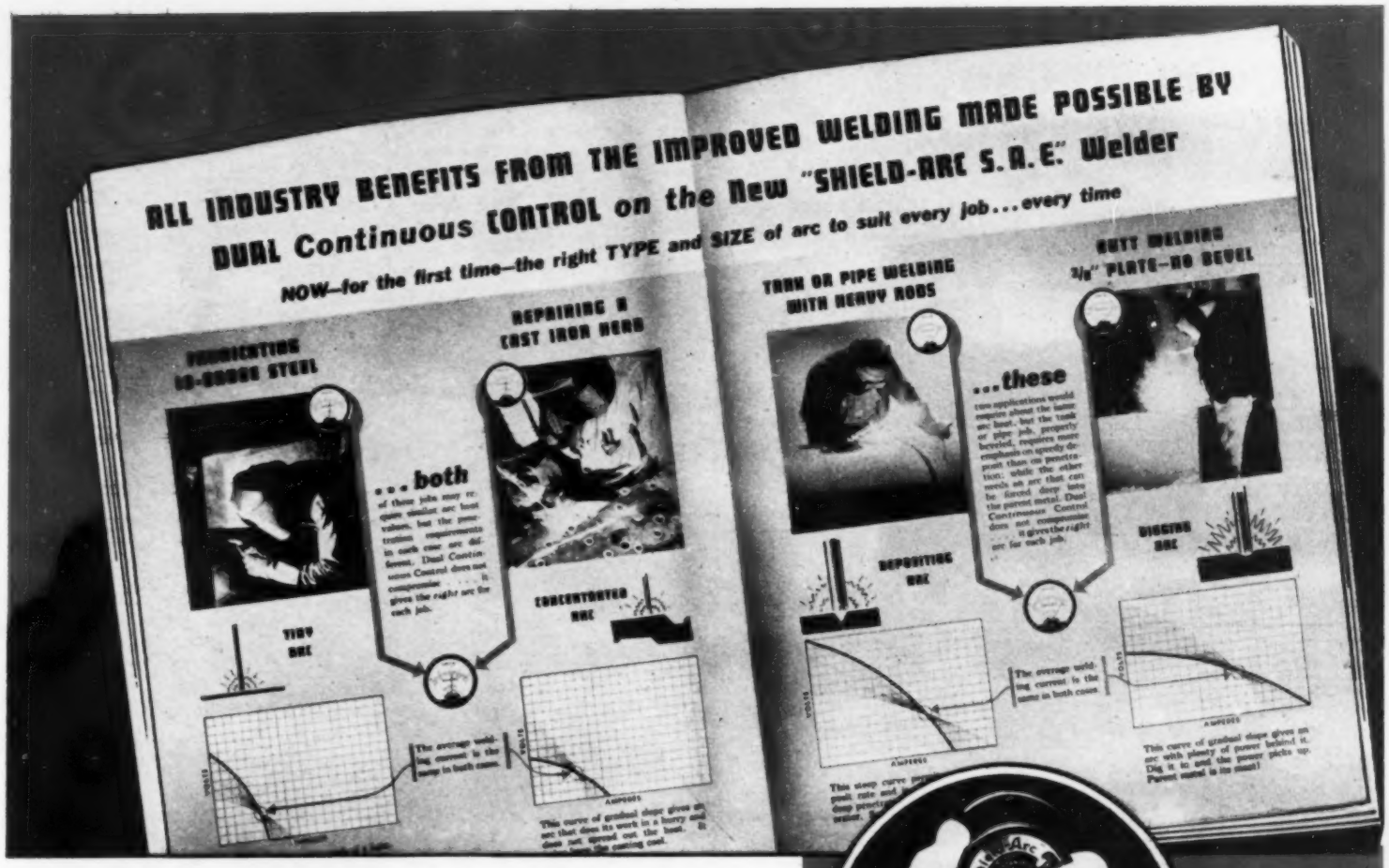
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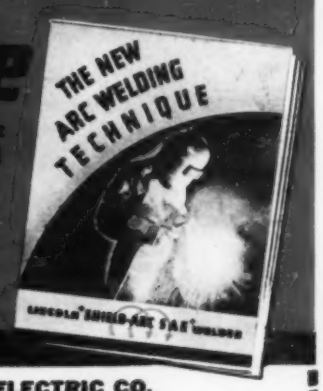

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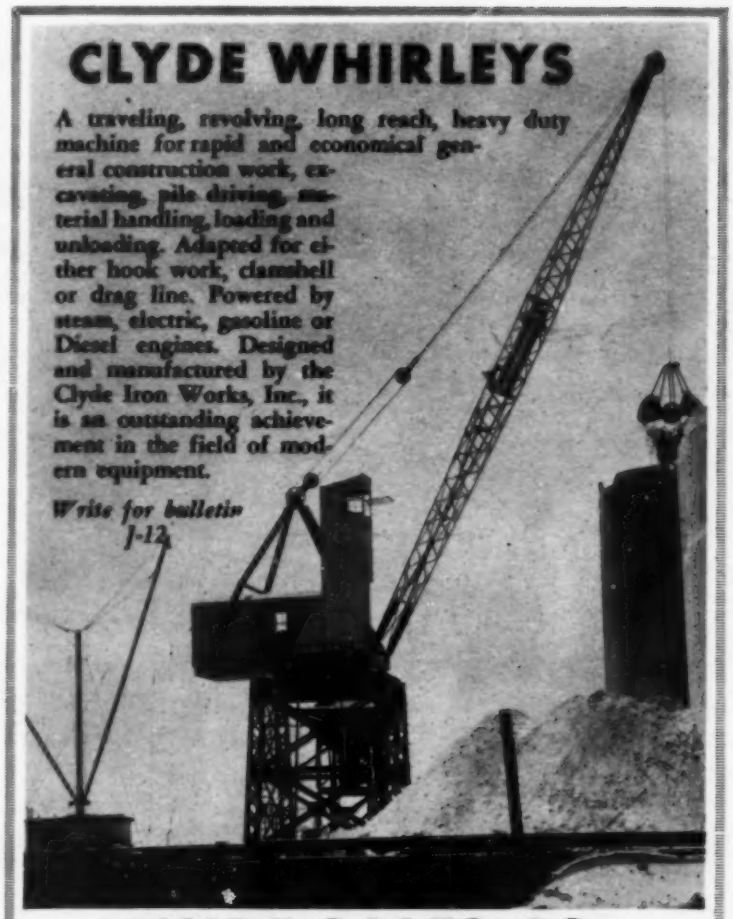

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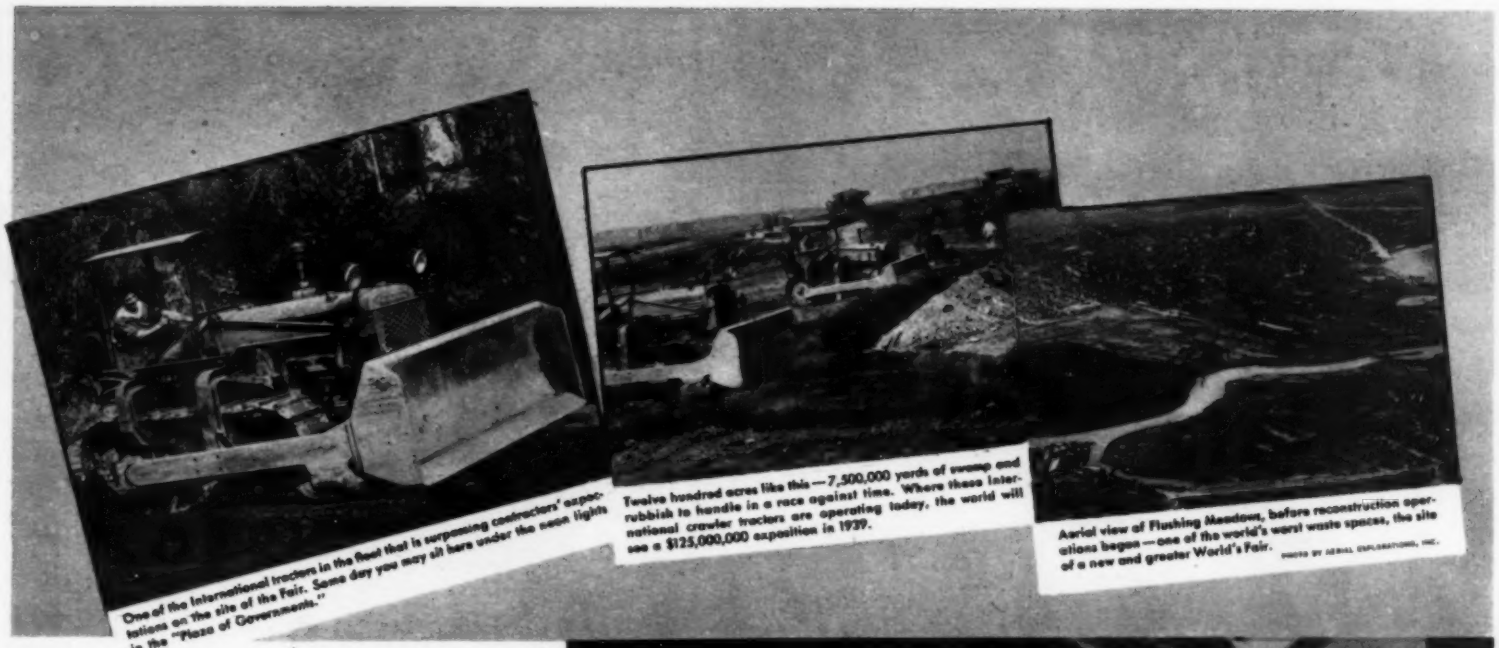

One of the International tractors in the fleet that is surpassing contractors' expectations on the site of the Fair. Some day you may sit here under the neon lights in the "Plaza of Governments."

Twelve hundred acres like this—7,500,000 yards of swamp and rubbish to handle in a race against time. Where these International crawler tractors are operating today, the world will see a $125,000,000 exposition in 1939.

Aerial view of Flushing Meadows, before reconstruction operations began—one of the world's worst waste spaces, the site of a new and greater World's Fair.

PHOTO BY AERIAL EXPLORATIONS, INC.

INTERNATIONAL Crawler Tractors

LAY GROUNDWORK FOR

NEW YORK WORLD'S FAIR 1939

The ancient Brooklyn Ash Dump in the Flushing Meadows on Long Island—miles of man-made desert where Manhattan and Brooklyn have heaped their rubbish for forty years—is a scene of great activity this winter. In 1939 New York City will entertain you there at a greater World's Fair.

Right now it's a job for the Johnson-Necaro Co., who shouldered a $2,000,000 contract to handle 7,500,000 yards of tangled refuse in a race against time. On April 1 they will deliver parks and lagoons where they took over chaos in the form of ashes and old iron.

The Johnson-Necaro Co. is coming on fast with International TracTracTors—the crawler-tractor product of International Harvester. A fleet of T-40 TracTracTors and bulldozers has been on the job for months now, handling 90 per cent of the vast yardage of material coming from the shovels and dump wagons.

Out there on Long Island today W. R. Staehlin, general superintendent, will tell you about how much these tractors can take, and how they perform while taking it. William Beattie and Charles Downing, chief engineer and general master mechanic, respectively, prove to us that what we claim about International service, and about accessibility of working parts, is understatement. And A. D. Saunders, operating vice-president, goes over the whole matter and says "That goes not only for me but for everybody on the job. I'd duplicate the entire order right now if we needed to."

This wouldn't mean so much coming from a green outfit, but the Johnson-Necaro organization is "tops" in the East. They have taken care of a $200,000,000 total in subway, tunnel, and other work in Metropolitan New York. They know crawler tractors from A to Z—*now.*

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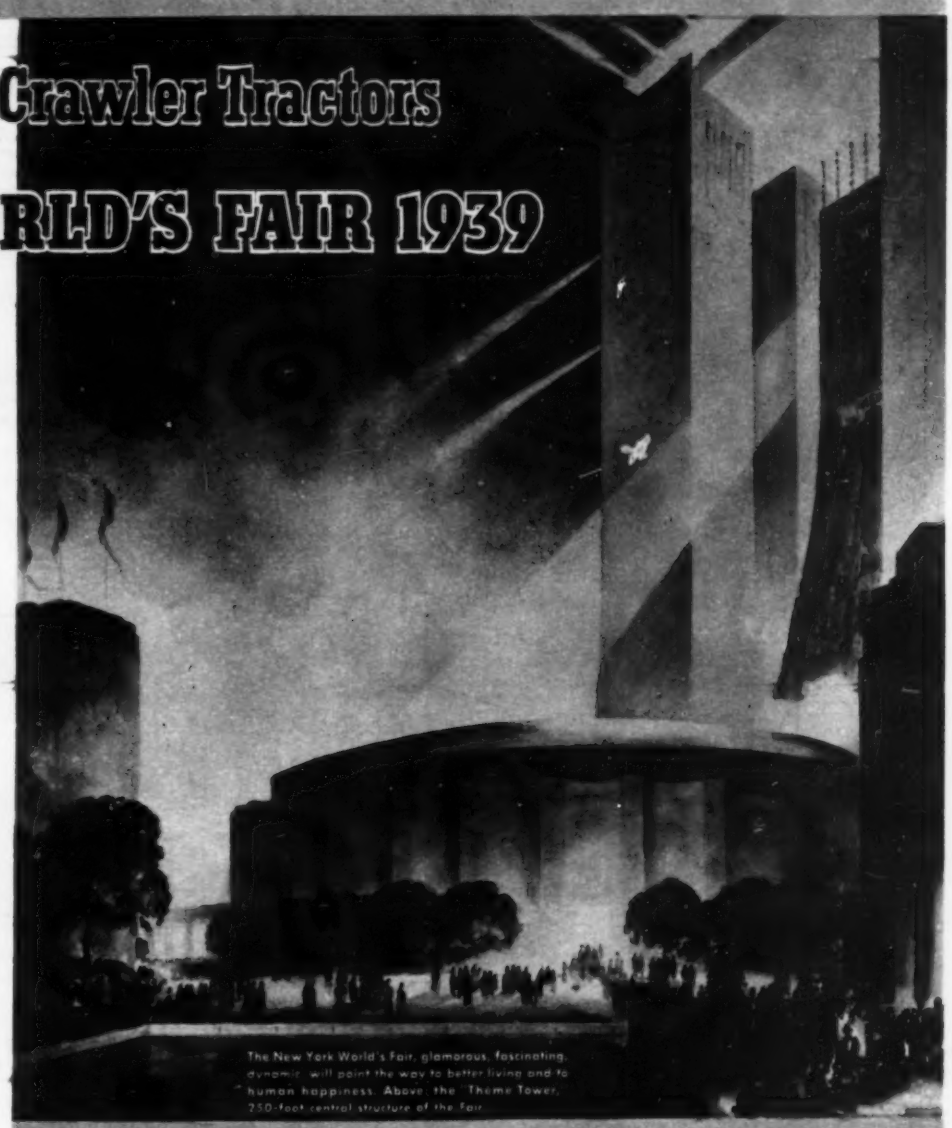
606 S. Michigan Ave. (INCORPORATED) Chicago, Illinois

W. R. Staehlin, general superintendent of the Flushing Meadows project. His grandfather held the chair of mathematics at Heidelberg, but Staehlin is no "chair" man. Thirty-two years on the job for the Arthur Johnson Co. have taught him volumes about the practical handling of heavy contracts. A big revelation to him of late has been the efficiency and economy of International TracTracTors.

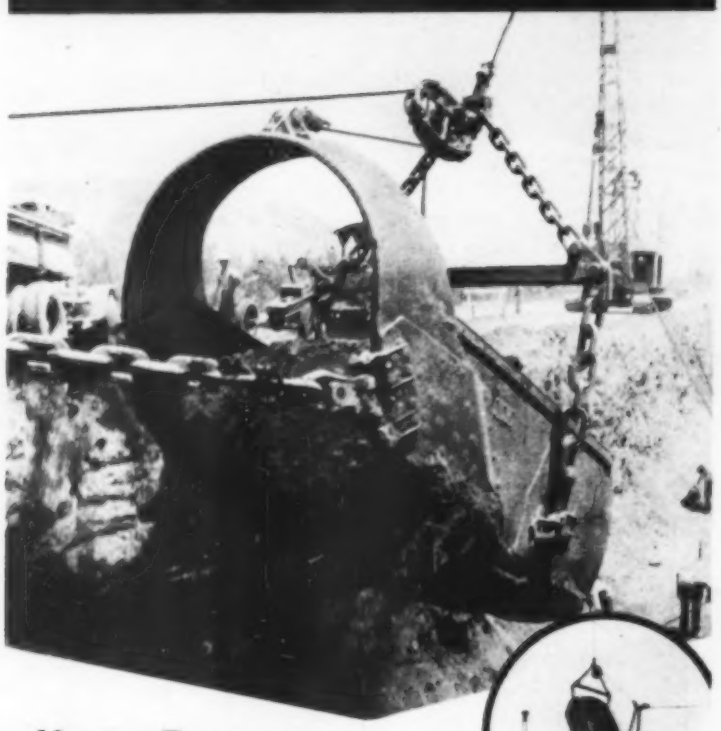


The New York World's Fair, glamorous, fascinating, dynamic, will point the way to better living and to human happiness. Above: the Theme Tower, 750-foot central structure of the Fair.

INTERNATIONAL HARVESTER

INDUSTRIAL TRACTORS . . . POWER UNITS . . . TRUCKS

Speed up DRAGLINE WORK 20% to 50% with a PAGE AUTOMATIC



Users Report
On Yardage Increases
Read Their Results:

One Contractor writes:

*"Excavation was around walls and involved the digging of hard clay to a depth of 28 feet This work was completed in three months—one-half the time we figured necessary."

Another AUTOMATIC owner reports:

*"We are stripping 25' overburden, some of which is hard pan and rock. Since putting on the AUTOMATIC we are stripping at least 50% more material."

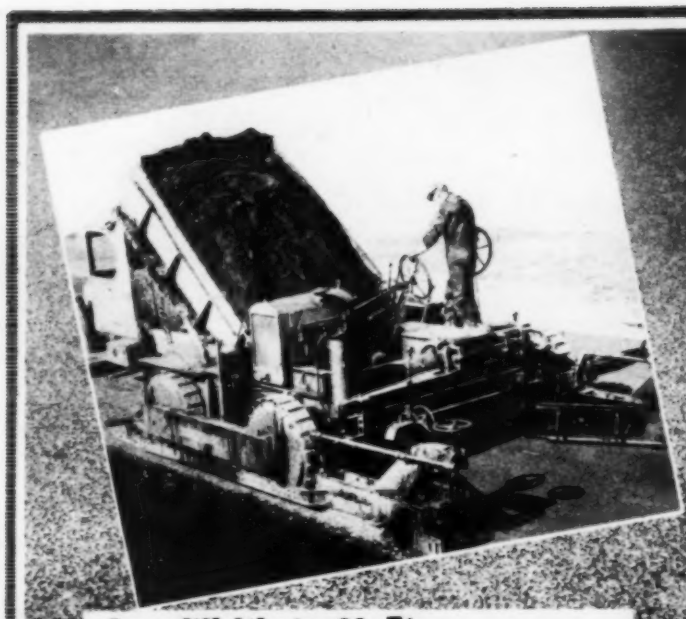
From letters in our files.

Ask any AUTOMATIC owner or operator about their yardage records with the patented rounded front AUTOMATIC bucket! Then see your equipment dealer or write us direct for information on a size and weight bucket best for your machine and job. Bulletin "THE AUTOMATIC" gladly sent on request.

BUILT IN SIZES 3/8 to 15 CUBIC YARDS

DIG WITH A PAGE AUTOMATIC!
ADDRESS DEPT. S.

PAGE ENGINEERING COMPANY
CLEARING POST OFFICE CHICAGO, ILLINOIS

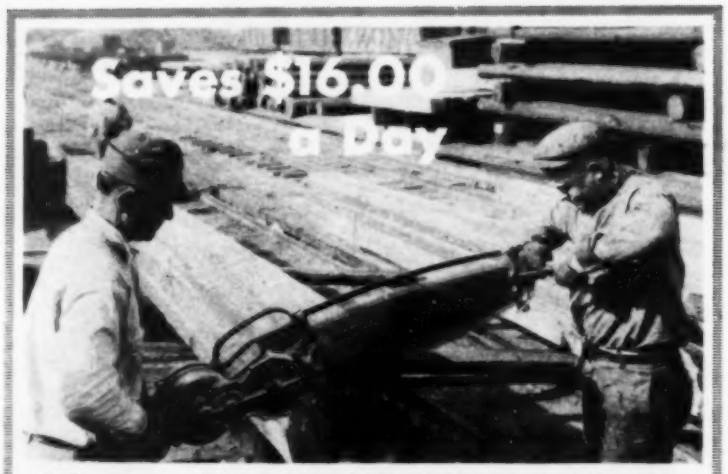


Any Width to 14 Ft.--
Laid Smooth as Velvet--
Faster than Your Plant Can Mix

With its 18 ft. straight-edge runners to equalize the surface, its semi-crawler traction all on hard subgrade, its pug-mill spreader, its ability to blend smooth joints and adjustability up to 14 ft. widths--the Jaeger Paver lays precision smooth pavements, faster and at lowest known cost. Send for Catalog and Prices.

THE JAEGER MACHINE CO. 800 Dublin Avenue Columbus, Ohio
World's Largest Builder of Spreading and Finishing Machines

JAEGER *Bituminous* **PAVER**



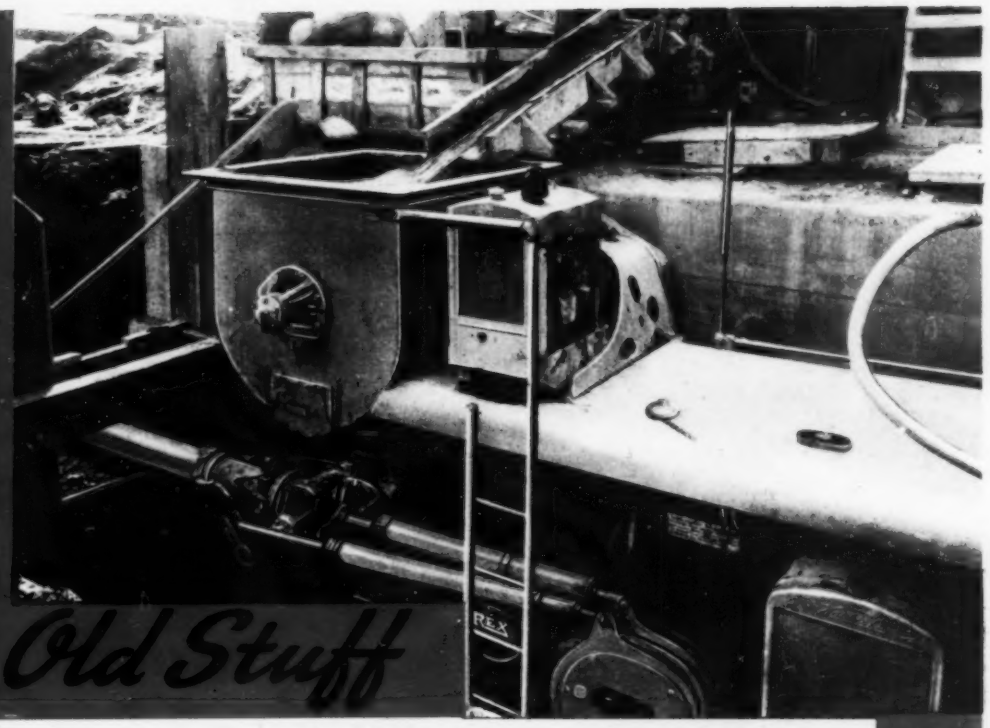
● The Texas and New Orleans Railroad Company are big users of timber — operating their own wood preserving plant — where the accompanying photograph was taken. Besides endorsing the dependable, efficient, service rendered by their Wolf Portable Sawing Machine they estimate a definite saving of $16.00 a day in time and labor costs.

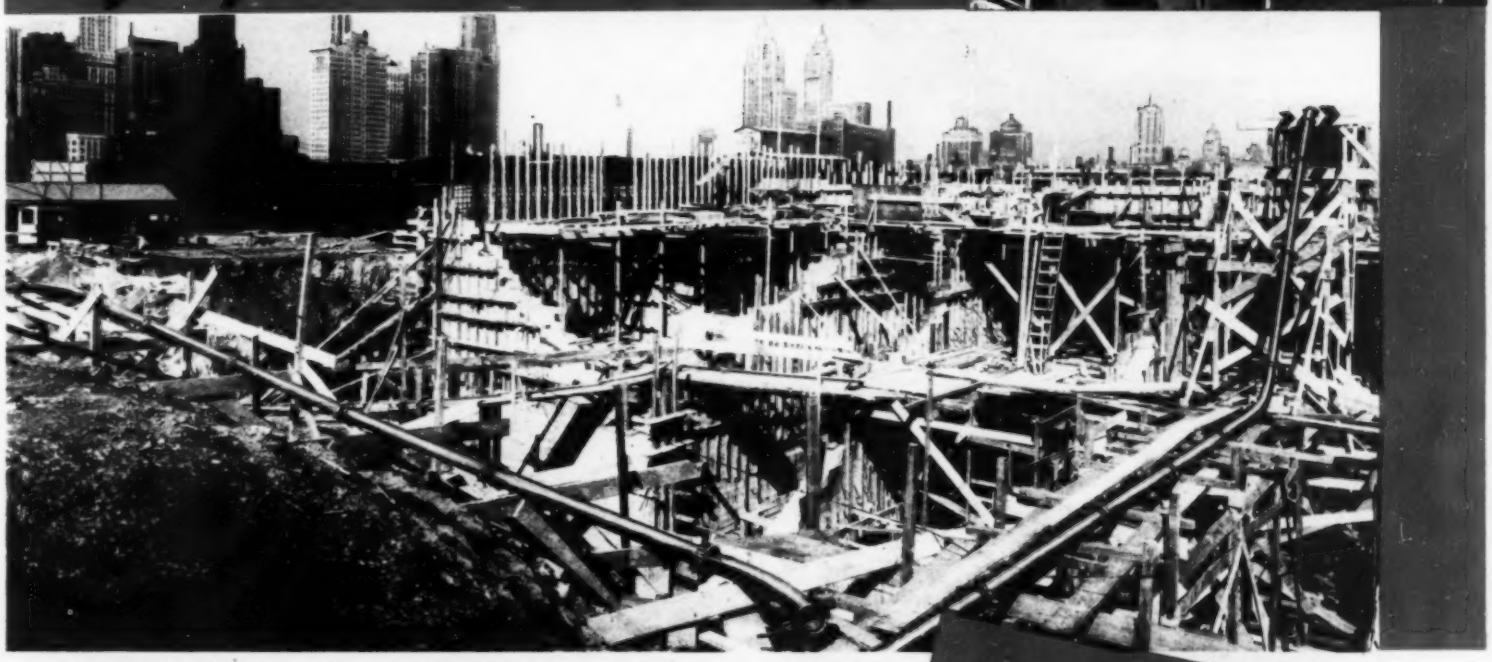
Wherever large quantities of heavy timber piling, etc. must be cut, the Wolf Portable Sawing Machine can be relied upon to pay for itself in a short time — and to earn a big profit for many years afterward. Made in 16", 24", 36" and 48" capacities. Driven by either electric, air or gasoline motors. Write today for complete information.

REED-PRENTICE CORPORATION
WORCESTER MASS.

Wolf Electric Portable Saw

ON *Chicago's* NEW OUTER DRIVE IMPROVEMENT IT PAID *to forget the Old Stuff*





ABOVE RIGHT: *Concrete grout for columns flowing into the Pumpcrete hopper via a wooden chute from the mixer . . .* ABOVE: *The Pumpcrete pipe line running north about eighty feet and then up a forty-five degree angle for a forty-foot run into a floor hopper. To the left of the main pipe line can be seen the auxiliary pipe line for pouring the western side of the north and south walls and piers.*

● Construction difficulties were plenty on this south portion of Chicago's $10,000,000.00 Outer Drive improvement. The economical pouring of concrete was the hardest problem to solve. Old-time methods for pouring concrete would have cost a fortune.

How the Pumpcrete Proves Its Flexibility

The Pumpcrete placed at the central mixing plant ended the need for numerous costly runs, towers and chutes. The Pumpcrete pipe line carries the concrete to any desired location; in one case the line runs east, north, west and then south for two hundred feet to pour directly into the wall and column forms.

Auxiliary pipe lines are connected as desired, up to a thousand feet, to pour piers, walls, sloping buttresses and decks, varying in height from three to fifty feet. There's no system for pouring concrete so flexible as that.

Averages Over 27 Yards Per Hour

In a day's run of sixteen hours, this single Pumpcrete pumped 28½ cubic yards of concrete per hour. On several 8-hour-day runs it averaged 27 to 30 yards per hour, with a one-minute mix.

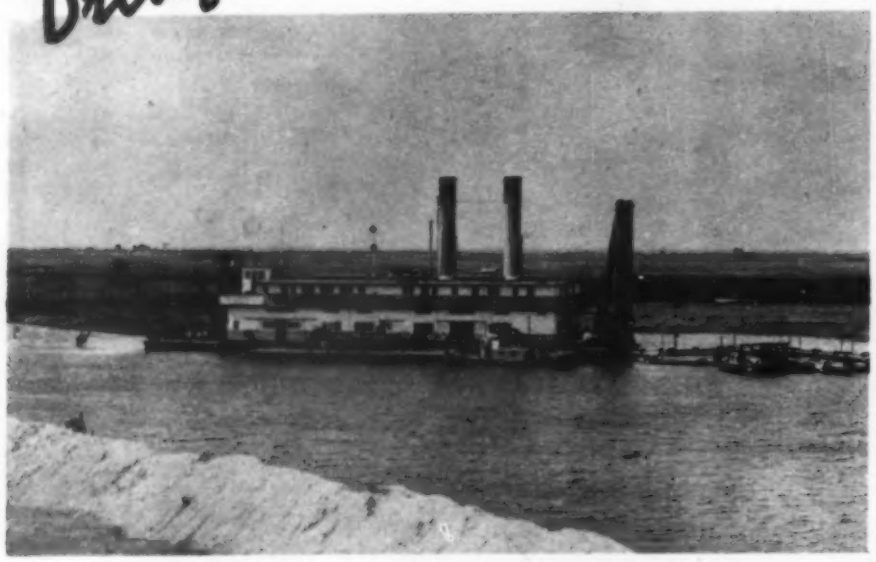
Write us for a descriptive booklet of the Pumpcrete.

CONCRETE *by* PIPELINE *with* REX PUMPCRETE

CHAIN BELT COMPANY
1664 W. Bruce Street, Milwaukee, Wis.

for Dredges!

When you are fitting out be sure they are



GOODALL
RED RING
DREDGING SLEEVES

They will assure the sort of service that means profit to you.

EXTRA YARDAGE
LONGER LIFE
AND BUILT TO STAND
THE HARDEST SERVICE

("Red Ring" Sleeves pass the rigid requirements of the U.S. Federal Specifications.)

Other GOODALL *items built especially for the Dredger*

Sparton Dredge Suction Hose
'76 Steam Hose
Buckskin Water Hose
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New York Philadelphia Pittsburgh Chicago Cleveland Houston

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Mills: Trenton, N. J.

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The originators of the "Standard of Quality" Line (Reg. U. S. Pat. Off.) of contractor's rubber goods.

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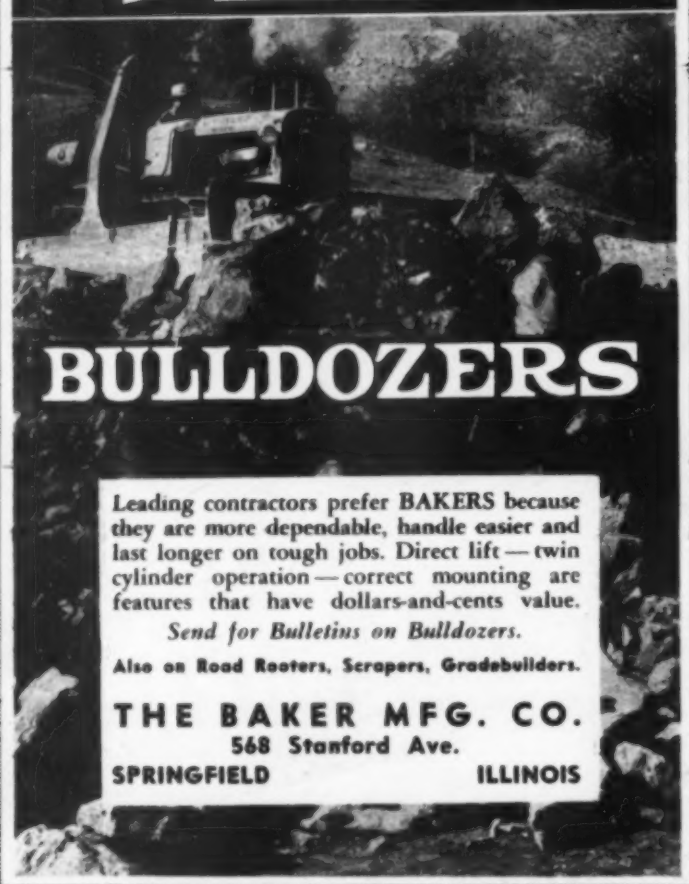

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Leading contractors prefer BAKERS because they are more dependable, handle easier and last longer on tough jobs. Direct lift — twin cylinder operation — correct mounting are features that have dollars-and-cents value.

Send for Bulletins on Bulldozers.

Also on Road Rooters, Scrapers, Gradebuilders.

THE BAKER MFG. CO.
568 Stanford Ave.
SPRINGFIELD ILLINOIS

THE BEST PAYS THE MOST

For that wet job — rent or buy a Moretrench Well-point System. Years of experience enable us to provide the right amount of what is conceded to be the finest equipment ever made for predraining purposes.

To our ever growing list of customers we wish
A Very Merry Christmas
and
A Happy and Prosperous New Year

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Sales and Rental Office: 90 West Street, New York
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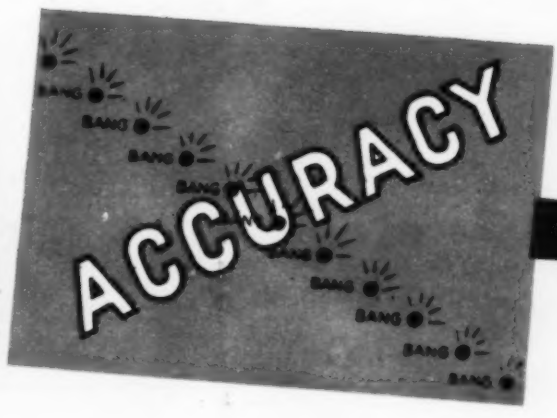
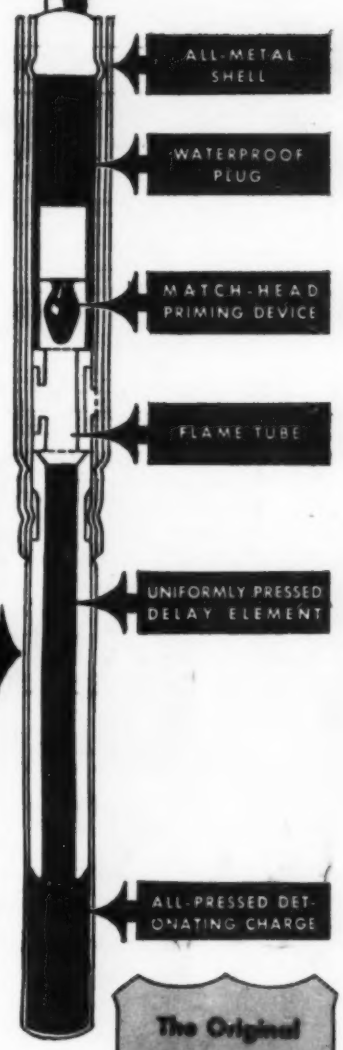
ACCURACY

is the Essential Feature of a Delay Electric Blasting Cap





The Original All-Metal Delay ... an Atlas First of 1928

ATLAS Delay Electric Blasting Caps are noted for compactness . . . waterproof qualities . . . rigid construction . . . and scientifically correct features of design. Yet when all is said and done unfailing *accuracy* is their greatest recommendation . . . and should be *your first consideration.*

When it comes to checking the action of Delay Electric Blasting Caps . . . *hearing* is believing! How do *your* shots say "Bang?" At precise intervals . . . meaning accuracy of delay in firing . . . perfect firing? Or irregularly . . . haphazardly . . . meaning inaccuracy, overlapping . . . bad blasting?

The Atlas All-Metal Delay Electric Blasting Cap provides the *accuracy* of timing without which no delay electric blasting cap can give you the service and the savings you have every right to expect.

ATLAS POWDER COMPANY, WILMINGTON, DEL.

Cable Address—Atpowco

Everything for Blasting

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Allentown, Pa.	Joplin, Mo.	New Orleans, La.	Pittsburgh, Pa.	Spokane, Wash.
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ATLAS
EXPLOSIVES

CHEMICALS ATLAS EXPLOSIVES

ABEL & DOBSON report...

G&R PUMPS never clogged steady pumping six months— usually 24 hours a day

JOBS like this one — jobs that call for steady, large volume, long continued pumping — best explain the enthusiastic preference of profit wise contractors for G & R Self Priming Centrifugal Pumps.

When they had completed work on the Keystone Dam of the Platte Valley Public Power and Irrigation District project, Abel and Dobson, of Lincoln, Nebraska, found that the two 6" G & R Pumps purchased through Anderson Equipment Co., of Omaha, had again come through with a record of perfect performance. During the six months they were on this job, the pumps were kept going most of the time, not once having to be shut down for clean out. Not only did they keep water moving in large volume, 24 hours a day, while used in dewatering the dam site, but they also demonstrated their all-round usefulness when, connected in tandem, they were used for jetting piling.

The rugged simplicity of these gadgetless self priming centrifugals recommend them for your next water handling job. Distributors in 100 principal cities are ready to make prompt delivery of G & R Pumps.

USERS of G&R PUMPS agree that they are truly the MOST DEPENDABLE PUMPS for the LEAST MONEY

THE GORMAN-RUPP CO.
MANSFIELD, OHIO.

COFFING ADVANCED DESIGN HOISTS

LIGHT
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COMPACT
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PORTABLE
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POWERFUL

DON'T TAKE OUR WORD FOR IT

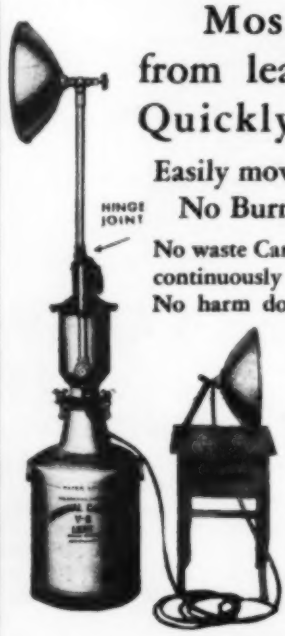
We'll gladly arrange for you to try these one man powerful ratchet hoists and prove for yourself the abuse they'll take. They'll lift or pull heavy pipe or machinery, heavy cable and do hundreds of other jobs. The final test on all furnished units is 100% over rated capacity! Built from ¾ to 6 tons capacity, weight 14 to 65 lbs. Write for Catalog.

COFFING HOIST COMPANY
DANVILLE ILLINOIS

NATIONAL CARBIDE V-G LIGHTS

Most Light from least Carbide Quickly Charged

Easily moved—No wires
No Burner Troubles



No waste Carbide whether used continuously or intermittently
No harm done if tipped over

Extension to X-100 DOUBLES THE CANDLE POWER *fastens anywhere*

Always use NATIONAL CARBIDE *"In the Red Drum"* Distributors Coast to Coast

WRITE FOR COMPLETE INFORMATION

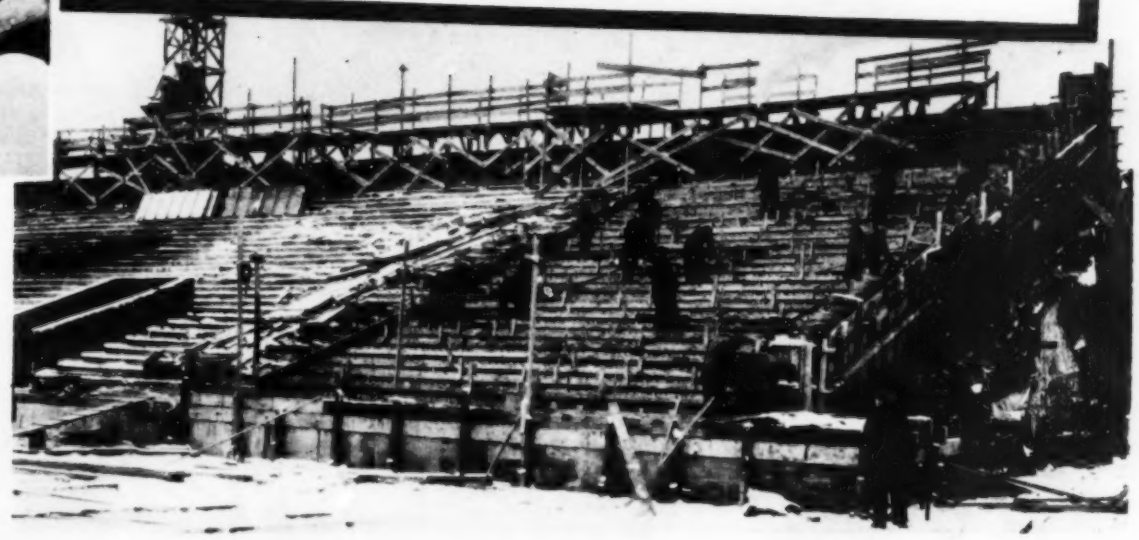
Y199 NATIONAL CARBIDE V-G HANDY LIGHT
Burns about 5½ hours on 1¾ lbs. of 14-ND Carbide, 2 gals. water; delivers about 1500 c.p. Weighs 37 lbs. charged—easy to carry, handy in emergencies.

WL1-C1 NATIONAL CARBIDE LANTERN
Burns 8 hrs. on 8 oz. of Carbide. Brilliant rear signal of red, blue or green, no extra charge . . . Ideal for emergency lighting on road at night.

X-100 NATIONAL CARBIDE V-G LIGHT
About 8,000 c.p. for 12 hours on 7 lb. charge of National Carbide. Easily handled by one man. Weight 35 lbs. empty; 90 lbs. full.

NATIONAL CARBIDE CORP.
LINCOLN BUILDING
Opposite Grand Central, NEW YORK

CONTRACTORS IN-THE-KNOW SAY, "EVERY COLD WEATHER CONCRETE JOB NEEDS CALCIUM CHLORIDE"



Construction carried right through the winter, with calcium chloride in the mix. (Barberton, Ohio, High School Stadium.)

CALCIUM CHLORIDE CURING MEANS UNINTERRUPTED COLD WEATHER CONSTRUCTION

CALCIUM chloride adds so many values to concrete that it should be used the year 'round. Some of these values are so enhanced in winter work as to make it indispensable. Of greatest value for winter concrete is the acceleration of setting time and the higher early and ultimate strength which assure safe strengths in half the time.

Calcium chloride not only shortens the time required for protection against freezing, but it also makes concrete more workable, so that it flows more freely into forms and fills them better without tamping. This gives better finish to form work, particularly balustrades, copings, railings and pillars.

Faster floor finishing is possible with calcium chloride in the mix, and the time to have concrete ready for the finishers may be controlled by the amount used.

Calcium chloride not only offers all of these advantages but the importance of its use in winter is made plain by this paragraph from the U. S. Bureau of Standards report, viz., "Calcium chloride not only greatly increases the early strength, but also appreciably increases the three-year strength. All concretes with calcium chloride have greater strength than plain concrete at all ages."

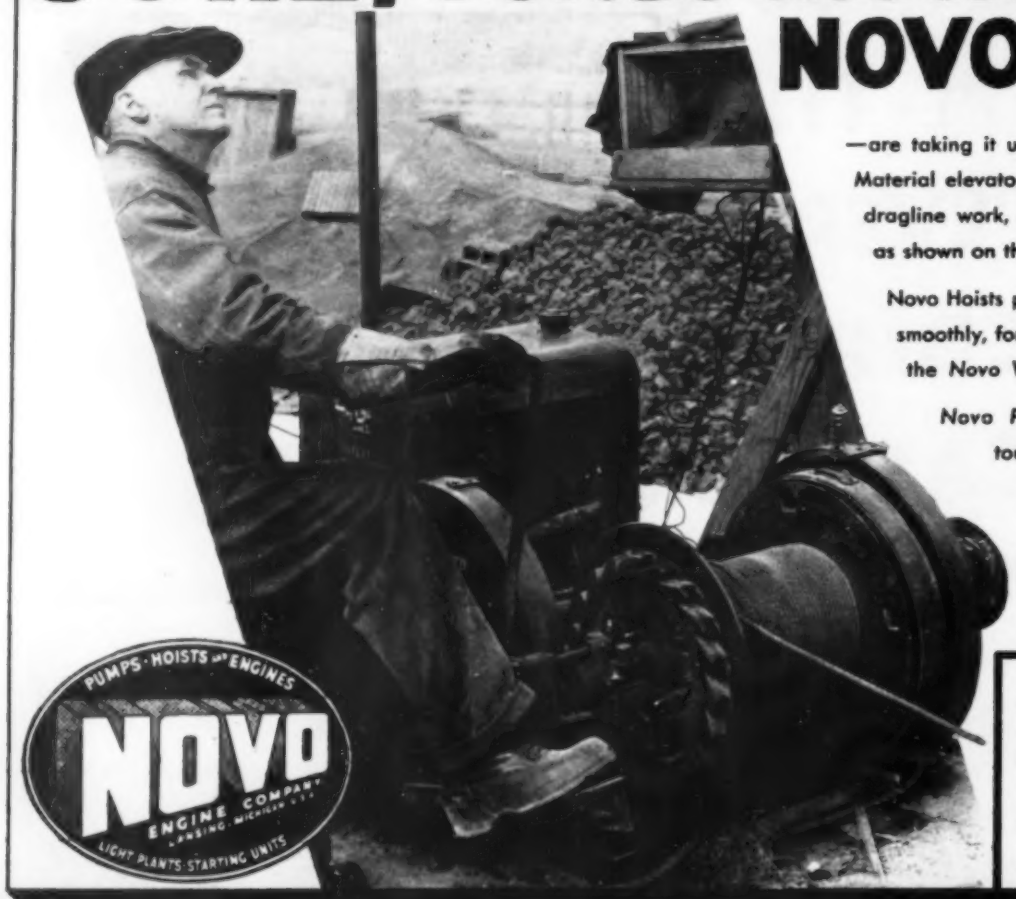
Write Association members for specifications and data on methods of calcium chloride admixtures in concrete.

CALCIUM CHLORIDE ASSOCIATION

THE COLUMBIA ALKALI CORPORATION, Barberton, Ohio
THE DOW CHEMICAL COMPANY Midland, Michigan
MICHIGAN ALKALI CO. 60 E. 42nd St. New York City
SOLVAY SALES CORP. 40 Rector Street, New York City

CALCIUM CHLORIDE
FOR SAFE, YEAR 'ROUND CONCRETE CONSTRUCTION

SURE, Construction's UP! NOVO HOISTS—



—are taking it up every day on a wide range of jobs. Material elevators, concrete masts, pile driving, erection, dragline work, etc. Sizes range from the little devils, as shown on the left, up to 100 HP, 14,000# line pull.

Novo Hoists pick up their load easily and shoot it up smoothly, for they have a greater friction area with the *Novo V Shaped, Double Area Friction Blocks.*

Novo Patented Screw Thrust gives feather touch control, minute accuracy of operation and an ease of manipulation that cuts operation overhead and operator fatigue.

Send for descriptive literature.

PUMPS · HOISTS and ENGINES
NOVO
ENGINE COMPANY
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LIGHT PLANTS · STARTING UNITS

NOVO ENGINE COMPANY
214 Porter St., Lansing, Mich.
Send me without obligation literature and prices on Novo Hoists. Size_____
Name_____
Address_____
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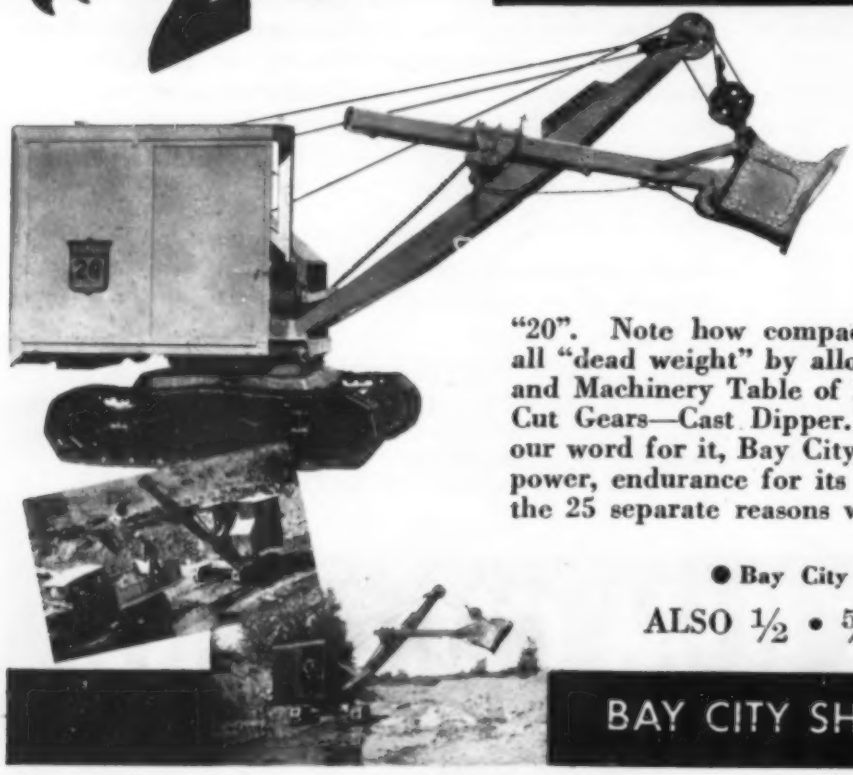
Bay City "20"

the biggest "little" shovel on the market



full swing—3/8 yard safe 4-ton crane load

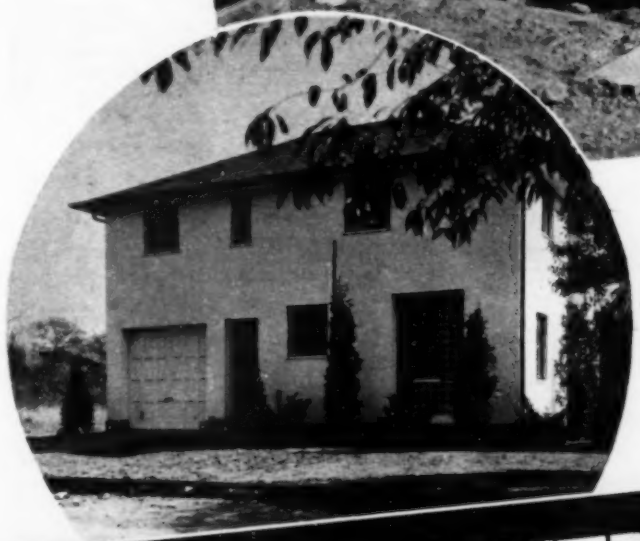
There are ten models of Bay City Shovels—but Bay City "20" is the greatest buy on the market if you want pep and power packed into small space. LOOK INSIDE THE CAB of a Bay City "20". Note how compact, yet sturdy and efficient. We've eliminated all "dead weight" by alloy steels and heat treating. Unit Cast Car Body and Machinery Table of Nickel-Manganese Steel. Chain Crowd—Helical Cut Gears—Cast Dipper. Space forbids us to tell all the details—take our word for it, Bay City "20" is not a TOY. It tops the field in speed, power, endurance for its weight and price. Write today for the details, the 25 separate reasons why it will pay you today.

● Bay City "20" no matter what your shovel needs.

ALSO ½ • ⅝ • ¾ • ⅞ • 1–1¼ YD. SIZES

BAY CITY SHOVELS Inc. BAY CITY, MICH.

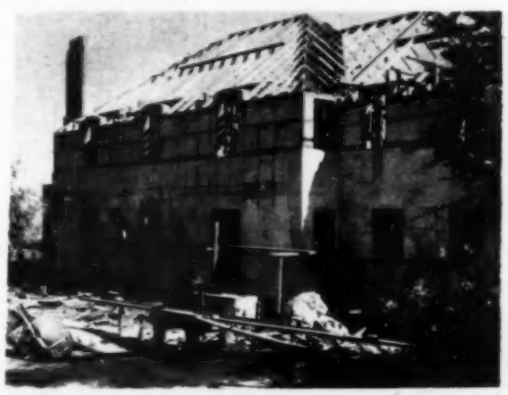
Precast concrete joists cut the cost of concrete floors — speed construction; easy to transport and handle; joist manufacturers in your vicinity will help you estimate concrete floor costs.



One of a number of concrete homes being featured in Champlin Square subdivision by Buffett Holding Co., Inc., West Englewood, New Jersey.

GENERAL CONTRACTORS: BUILD *Concrete* HOMES FOR REALTORS

Every home needs a concrete floor.



Monolithic home being erected with one of several form systems available to help the builder cut costs.

A record year in the volume of **concrete** homes now draws to a close — and a new year with new records in prospect lies ahead! Now is the time to make your plans to cash in on this active market. Realtors and subdividers are organizing construction departments or seeking connections with builders. Tie up with such a realtor. There's profit in a cooperative arrangement!

Concrete's beauty and adaptability, its moderate first cost and low upkeep, its firesafety and permanence, combine to give concrete homes superior salability. Whether you build with masonry or reinforced concrete, you can capitalize your skill and experience in organizing the construction of walls, floors, stairways and roofs of concrete. And there are extra profit opportunities in porches, sidewalks, terraces, driveways and garages.

Your experience, equipment and personnel enable you to build concrete homes economically — one at a time or by the hundreds. Check the coupon and attach to your letterhead for further information and practical booklet.

PORTLAND CEMENT ASSOCIATION
Dept. A 12-14, 33 W. Grand Ave., Chicago, Ill.

(☐) I am interested in home construction as a contracting opportunity.
(☐) Send, "Reinforced Concrete Houses — Construction Details."

Name .....
Company .....
Address .....
City ..... State .....

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If you do not find all you need in the advertising section, we shall be glad to assist you. Write to—

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330 West 42nd St. New York City

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Texas Company

ASPHALT PLANTS
Blaw-Knox Company
Hetherington & Berner, Inc.

BACK FILLERS
Harnischfeger Corp.
Link Belt Co.
Northwest Engineering Co.

BARS, IRON AND STEEL
American Rolling Mill Co.
Inland Steel Co.

BATCHERS, ADJUSTABLE MEASURING
Blaw-Knox Company

BELTING
Goodall Rubber Co.

BINS, STORAGE
Blaw-Knox Company
Chain Belt Company
Jeffrey Mfg. Co.

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Atlas Powder Co.
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BOLTS, NAILS, NUTS, RIVETS and SPIKES
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Goodall Rubber Co.

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Calcium Chloride Ass'n.

CARBIDE
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CEMENT
Lone Star Cement Corp.
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EXCAVATORS, DRAGLINE
Bay City Shovels, Inc.
Bucyrus-Erie Co.
Harnischfeger Corp.
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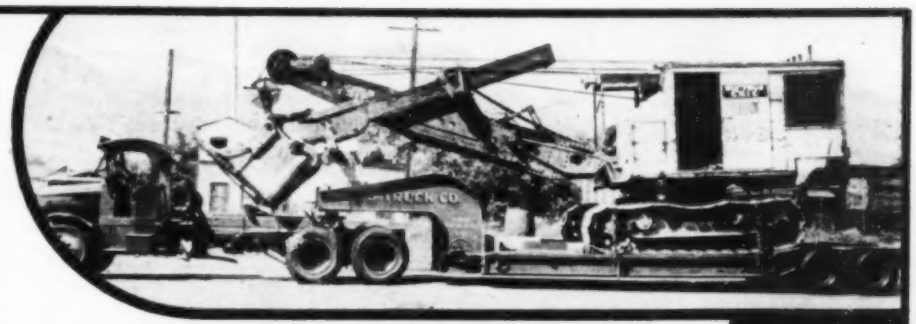

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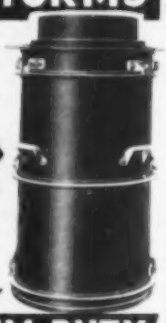

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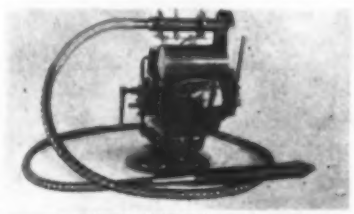

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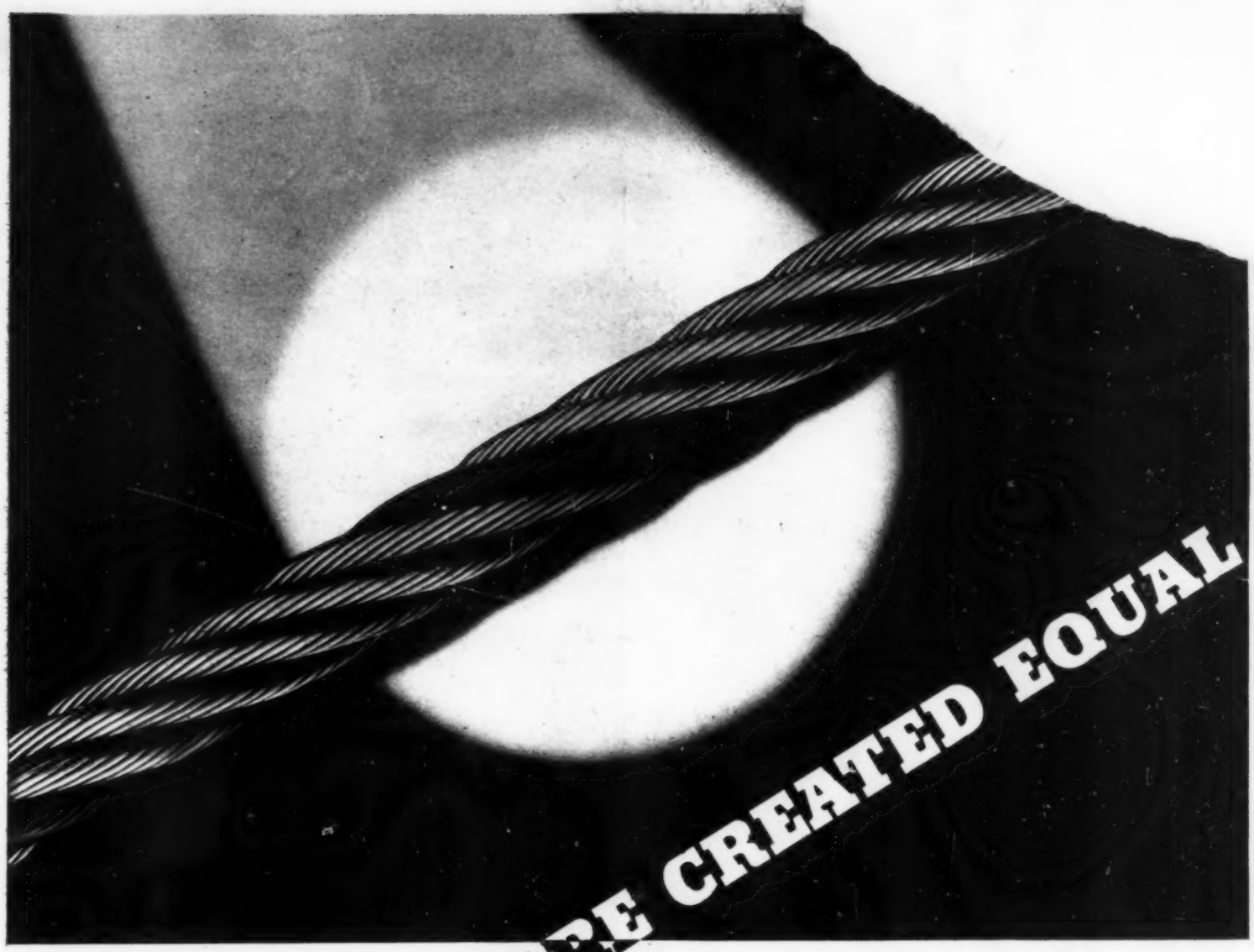

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